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SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 9.—Published April 26th, 1906.

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R. ETHERIDGE, Junr., J.P., Curator.

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OCT 17 1906

SPONGES.

Part I.

By THOMAS WHITELEGGE,

Zoologist, Australian Museum.

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SPONGES.

By Thomas Whitelegge.

Zoologist, Australian Museum.

MONAXONIDA, *Ridley and Dendy.*

Part I.

(Plates xliii.-xliv.)

The collection obtained during the brief cruise of H.M.C.S. "Thetis" proved to be exceptionally rich in sponges; over one hundred and fifty species were procured, and approximately fully one half are either rare or new species.

The present paper deals with a little less than half of the *Monaxonida*, and includes nineteen new species, a number of others of great interest—hitherto only obtained by H.M.S. "Challenger"—and many other forms originally described by Dr. R. von Lendenfeld. The latter have been treated at some length, and have formed the basis of comparison between the types in the Australian Museum collection and the fragments received from Prof. A. Dendy, which were selected from the Lendenfeldian collection now in the British Museum. The material obtained enabled the writer to amend some of the descriptions and also the nomenclature of many of the exhibited specimens, as well as of those published in the "Catalogue of Sponges in the Australian Museum."

The new species herein described are as follows:—

Gellius reptans.
Rhaphisia ramosa.
Chondropsis syringianus.
Esperella ancorina.
„ *cylindrica.*
„ *textilis.*
Esperiopsis canaliculata.
„ *ferruginea.*
Cladorhiza waitei.
Phelloderma polypoides.
Desmacidon porifera.
„ *hispidosa.*
„ *stelligera.*
„ *conulissima.*
„ *? arenosa.*
Dendoryx pumicea.
„ *fusca.*
Iotrochota arbuscula.
Yvesia commensalis.

Of species previously described the following are the most worthy of note :—

Siphonochalina annulata, Ridley and Dendy.
Arenochalina mirabilis, Lendenfeld.
Ceraochalina levis, Lendenfeld (with its so-called algal pseudomorph).
Esperella murrayi, Ridley and Dendy.
Esperiopsis cylindrica, Ridley and Dendy.
Pseudohalichondria fibrosa, Whitelegge.
Amphilectus ceratosus, Ridley and Dendy.
Desmacidon fruticosa, Bowerbank.
Rhizochalina putridosa, Lamarck.

MONAXONIDA, *Ridley and Dendy.*

Order HALICHONDRINA, *Vosmaer.*

Family HAPLOSCLERIDÆ, *Topsent.*

Subfamily CHALININÆ, *Schmidt.*

CHALINA, *Grant.*

CHALINA MACROPORA, *Lendenfeld.*

Euchalina macropora, Lendenfeld, Zool. Jahrb., ii., 1887, p. 818.

Station 53.

A single example is here, somewhat doubtfully, referred to this species. A comparison with a fragment from the British Museum has been made, and it agrees with the "Thetis" specimen in external and general characters, but the spicules differ slightly in dimensions.

Sponge with numerous slender, erect, cylindrical branches; the latter are dichotomous at their origin, but when mature the lobes are unequal, their diameter varies from 5 to 10 mm., and they attain to a height of 220 mm. The surface is even, harsh to the touch, and exhibits a rather distinct reticulation, with abundant small pores and numerous shallow oscula; the latter are from 1 to 3 mm. in diameter, from 2 to 5 mm apart.

The skeleton consists of an open network of fibre with the mesh mostly square, rarely oblong. The primary fibres are about 0·05 mm. in diameter and 0·2 to 0·3 mm. apart. The core of oxeote spicules is more or less plumosely arranged, with their basal ends approximated and their apices divergent; they vary

from three to six or more in a row. In the secondaries the spicules are fewer and more closely arranged, and in the connecting fibres the spicules occur sparingly, one or two to each, or they may be absent. The terminal ends of the fibres project at the surface, forming radiating tufts of spicules; the intervening spaces of the dermis also exhibit clusters of subradiate spicules.

Megascleres:—sharp pointed oxea 0·08 to 0·1 mm. by 0·0045 to 0·006 mm. Spicules from the British Museum fragment measure from 0·08 to 0·09 mm. by 0·003 to 0·004 mm.

PACHYCHALINA, *Schmidt.*

PACHYCHALINA RAMOSA, *Lendenfeld.*

Chalinissa ramosa, Lendenfeld, Zool. Jahrb., ii., 1887, p. 772, pl. xx., fig. 21.

Stations 41, 44, 48, 50.

This species is represented in the "Thetis" collection by sixteen specimens; they exhibit considerable variation in the diameter of the branches and also as to the size and number of the nodosities; the whole of the branches in some examples are strongly moniliform, in others they are subcylindrical with slight constrictions at distant intervals.

Sponge stipitate, much branched; the branches are mostly lateral, but frequently they are dichotomous, and often coalescent. In contour they vary from cylindric to strongly undulate or moniliform, and are from 5 to 15 mm. in diameter and from 200 to 400 mm. in length.

Surface smooth, dense, and very finely porous; internally the texture is rather open, with a more or less square mesh. Oscula numerous, pretty evenly distributed, slightly elevated, from 1·5 to 3 mm. in diameter, on an average about 10 mm. apart, and generally situated on the rounded elevations.

Primary fibres multispicular, about 0·05 mm. or more in diameter and 0·5 mm. apart. Secondary fibres 0·03 to 0·04, with an axial core of six to eight or more spicules; connecting fibres slender, with four or more spicules in a row. The choanosome is fairly sprinkled with spicules, and the dermal surface exhibits numerous tufts of projecting oxea in clusters of about twelve or more; the space between each bunch is about equal to the length of the spicule.

Megascleres:—sharp gradually pointed oxea 0·085 to 0·1 by 0·005 to 0·006 mm.

There is a fragment from the British Museum which agrees in appearance, texture, and spicular characters with *P. ramosa*, Ldf., as above described.

PACHYCHALINA PEDUNCULATA, *Lendenfeld*, sp.

Plachochalina pedunculata, Lendenfeld, Zool. Jahrb., ii., 1887, p. 791; Austr. Mus. Cat., xiii., Sponges, 1888, p. 90.

Cavochalina bilamellata (Lamk.), Carter, Ann. Mag. Nat. Hist., (5), xvi., 1885, p. 287.

Pachychalina bilamellata (Lamk. ?), Carter; Dendy, Proc. Roy. Soc. Vict., n.s., vii., 1895, p. 242.

Stations 4, 48.

The late Mr. H. J. Carter first described this species from Port Phillip. At the time he thought it was identical with *Spongia bilamellata*, Lamarck, and named it accordingly. Previous to this Ridley* had examined a fragment of Lamarck's "original type specimen," and redescribed the Lamarckian species as *Echinodictyum bilamellatum*.

Pachychalina pedunculata, Lendenfeld, was published as an ideal species consisting of three varieties, which prove to be identical with Carter's sponge, and since they can no longer be considered as *bilamellata*, Lamarck, Lendenfeld's name must stand; the three varieties may be enumerated as follows:—

(1) *P. pedunculata*, var. *dura*, Lendenfeld. This variety is by far the most common, and usually consists of a short, stout stem surmounted by a pair of flabellate expansions. The dermal surface is smooth, close and compact, with discernable pores on the inner aspect, but it requires a lens to see those on the exterior. The lamellæ are about 8 or 10 mm. in thickness, and are ornamented with concentric growths internally; the outer surface presents a series of meandering ridges and wart-like prominences from 2 to 10 or more mm. in height. The spicules are slightly curved sharp pointed oxea 0·06 to 0·065 by 0.004 mm.

(2) *P. pedunculata* var. *pocula*, Lendenfeld. This form is narrowly cup-shaped, with the walls of the cup from 1 to 4 mm. in thickness. The external surface is furnished with warts and wavy ridges, but they are rarely more than 2 or 3 mm. high, and at the distal sixth they fade away. The spicules are curved oxea 0·06 to 0·07 by 0·004 mm.

(3) *P. pedunculata* var. *mollis*, Lendenfeld. This variety forms a very shallow cup with a well defined peduncle. The outer surface presents an irregular series of ripple or wave-like markings; the crests of the waves are generally acute and from

* Ridley—Journ. Linn. Soc., Zool., xv., 1881, p. 493, pl. xxviii., figs. 1-6.

2 to 10 mm. apart, with an indistinct concentric arrangement of the valleys between the ridges. The spicules are slightly curved oxea 0·06 to 0·07 by 0·004 mm.

This form, like many other species of the genus, is subject to great variation, and no doubt if a large series were secured it would be impossible to say where a definite line could be drawn, so as to warrant even a varietal name.

PACHYCHALINA AUSTRALIS, *Lendenfeld, sp.*

Euplacella australis, Lendenfeld, Zool. Jahrb., ii., 1887, p. 789

Euplacella frondosa, Lendenfeld, Zool. Jahrb., ii., 1887, p. 789, pl. xxi., fig. 36.

Stations 44, 47, 48.

When writing the "Report on Sponges from the Coastal Beaches of N. S. Wales"* I gave a short description of this species. The "Thetis" collection contains seven fine examples. They are all more or less stipitate, and vary from flabellate to plate or narrow cup-shape. The outer surface is smooth, and exhibits numerous growth lines, the pores are very minute and cannot be seen clearly with the unaided eye. The inner surface is closely sprinkled with abundant oscula from 0·5 to 2 mm. in diameter, and from 1 to 5 mm. or more apart. In young examples the oscula are large and rather distant. A few scattered oscula are invariably present on the external surface of the pedicle. The dermal reticulation on the outer surface is much finer than that on the inner. The skeleton consists of a rather dense plexus of broad ill-defined fibres, the mesh varies considerably, but is usually more or less oblong. The horny matter of the fibres is well developed and furnished with abundant oxeote spicules, especially in the central region; at the surface, however, the horny matter is scanty, and the spicules are disposed in one or two rows. The choanosome in dried examples is moderately charged with scattered spicules similar to those of the fibres. The spicules from a British Museum specimen of *P. australis*, Ldf., measure 0·075 by 0·004 mm., and those of *P. frondosa*, Ldf., 0·06 to 0·07 by 0·0037 mm. Spicules from the "Thetis" examples are rather larger and measure from 0·07 to 0·1 by 0·005 to 0·006 mm.; they appear to vary in size according to age, and are smallest in large specimens.

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* Whitelegge—Rec. Austr. Mus., iv., No. 2, 1901, p. 55.

PACHYCHALINA PAUCISPINA, *Lendenfeld.*

Pachychalina paucispina, Lendenfeld, Zool. Jahrb., ii., 1887, p. 776.

Sponge digitate, shortly stipitate, with numerous irregular, main, cylindrical branches; the lateral branches are given off at right angles, and the sponge in consequence tends to become wide above the pendancle. The upper part consists of slightly nodose, subcylindrical branches about 7mm. in diameter, with here and there a bifurcation; the longer branches attain to about 370mm. in length.

Texture rather soft and elastic. Surface smooth to the eye but harsh to the touch; the reticulation is very fine without any well-defined pores. Oscula few, shallow, and irregularly scattered, varying from 1 to 3 mm. in diameter. Colour in the dried example stone grey.

Skeleton with a rather wide mesh, oblong or subrectangular. The primary fibres are about 0·04 mm. in diameter and 0·44 mm. apart; the transverse secondaries are given off at intervals of about 0·5 mm.

The spicules are straight oxea, abruptly, but rather bluntly pointed. Size 0·1 by 0·002 to 0·003 mm.

The above-described specimen has been identified by comparison with a fragment from the British Museum, received under the name of *Dactylochalina paucispina*, Lendenfeld. I presume this is a m.s. name.

PACHYCHALINA PUNCTATA, *Ridley and Dendy.*

Pachychalina punctata, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 24, pl. vi., figs. 2, 2a, 2b, 2c, pl. xlvi., figs. 1-2; Lendenfeld, Zool. Jahrb., ii., 1887, p. 776; Whitelegge, Rec. Austr. Mus., iv., 1901, p. 69.

Station 8.

A single specimen was obtained; it assumes a folded, incomplete cup-like shape, with a semi-circular expansion at the base.

PACHYCHALINA COMMUNIS, *Lendenfeld, sp.*

Chalinissa communis, Lendenfeld, Zool. Jahrb., ii., 1887, p. 772; *Id.*, Austr. Mus. Cat., xiii., Sponges, 1888, p. 87, pl. vii.

Pachychalina communis, Whitelegge, Rec. Austr. Mus., iv., 1901, p. 20.

In the above paper Dr. R. v. Lendenfeld described under the generic name of *Chalinissa* eleven species and two varieties.

The "Thetis" collection contains a large series of fine specimens of *P. communis*, and these, together with the rich material in the Museum, afford ample examples for study. In addition there are several fragments—taken from Lendenfeld's collection now in the British Museum—which have been compared with the rest of the material at my disposal.

The result of the examination is a conviction that *P. communis*, Ldf.—with its two varieties *flabellum* and *digitata*—*P. elegans*, Ldf., *P. elongata*, Ldf., *P. tenuifibris*, Ldf., and *P. serpens*, Ldf., are forms of one extremely variable species. They differ slightly in habit, density, and in the relative size and distribution of the oscula. These characters are extremely variable according to the habitat in which the sponge has grown, and the same remark applies both to the fibrous skeleton and the spicules, There is one feature they have in common, and that is the appearance and structure of the dermal surface. These peculiar epidermal characters can also be seen in *P. punctata*, Ridley and Dendy, *P. pedunculata*, Ldf., and, judging from the description, in *Chalina monilata*, Ridley.

The dermal surface when well preserved is glabrous, velvet-like in appearance, and coated with a thin crust of oxeote spicules; the latter are very closely arranged, and partly conceal the dermal network as well as the pores, which are scarcely visible to the unaided eye. The spicular measurements are as follows:—*Pachychalina communis*, Ldf., "type," 0·06 to 0·08 by 0·0045 to 0·006 mm. In the choanosome there are a few 0·06 by 0·002 mm. *P. communis* var. *digitata*, Ldf., 0·06 to 0·07 by 0·006 mm. *P. communis* var. *flabellum*, Ldf., 0·06 by 0·006 mm. *P. elongata*, Ldf., 0·06 to 0·07 by 0·006 mm. *P. elegans*, Ldf., 0·065 by 0·0055 to 0·006 mm. *P. serpens*, Ldf., 0·06 to 0·08 by 0·0065 mm. in choanosome, and 0·06 to 0·07 by 0·0045 mm. in skeleton fibres. *P. tenuifibris*, Ldf., 0·06 to 0·07 by 0·0055 to 0·006 mm.

SIPHONOCHALINA, *Schmidt.*

SIPHONOCHALINA ANNULATA, *Ridley and Dendy.*

Siphonochalina annulata, Ridley and Dendy, Chall. Rep., Zool., xx., p. 31, pl. vii., fig. 2.

Station 48.

A single example of this species is present in the "Thetis" collection. The habit of the specimen is different from that of the figured type. The form is more compact, and on one side the whole of the branches exhibit coalescence for at least half or a third of their length. The specimen is 224 mm. high, 140 mm. in

larger, and about 100 mm. in its smaller diameter. The peduncle is 75 mm. long and from 7 to 10 mm. in diameter. Megascleres oxea 0·1 mm. by 0·0065 mm.

ARENOCHALINA, *Lendenfeld.*

ARENOCHALINA MIRABILIS, *Lendenfeld.*

Arenochalina mirabilis, Lendenfeld, Zool. Jahrb., ii., 1887, p. 821, pl. xx., fig. 70; *Id.*, Aust. Mus. Cat., xiii., Sponges, 1888, p. 103; Whitelegge, Rec. Austr. Mus., iv., No. 2, 1901, p. 76, and No. 5, 1902, p. 213.

Station 50.

Five examples of this species were obtained at the above-mentioned station; all were evidently dead when caught in the trawl. One exhibits a little sarcode, but it does not reveal any additional characters to those already described. The stylote spicules of the fibres and choanosome have been carefully measured, and are as follows:—0·15 to 0·19 by 0·004 to 0·0045 mm.

CERAOCHALINA, *Keller.*

CERAOCHALINA LEVIS, *Lendenfeld.*

Ceraochalina levis, Lendenfeld, Zool. Jahrb., ii., 1887, p. 782, pl. xix., fig. 19.

Sponge with a well defined base and short peduncle, 35 mm. long and 15 mm. in its shorter and 30 mm. in its greater diameter. The peduncle gives rise to a series of angular or compressed primary branches without any anastomozation, about one-third of which consists of short subcylindrical branches with round apices; their length is about 150 or 200 mm. and their diameter 10 to 12 mm. The remaining two-thirds of the branches are from 400 to 550 mm. in length, subcylindrical, and about 10 mm. in diameter. The longer branches exhibit two or three bifurcations. Dermal surface smooth in appearance to the unaided eye, but harsh to the touch. Pores minute, scarcely visible without a lens. Vents numerous, with thin elevated margins, pretty evenly distributed, 2 mm. or less in diameter, and on an average about 8 mm. apart. Colour in the dried condition yellowish-stone.

Skeleton rather wide-meshed, the main fibres curve gracefully from the centre outwards and terminate in small tufts of spicules at the surface; these tufts, with other scattered spicules, project

at least half their length through the dermal membrane. The primary fibres are about 0·01 to 0·15 mm. in diameter and 0·5 mm. apart; the spicular core consists of a thin undulating line of ill-arranged oxea; these are either multiserial, or, in the slender parts, five or six in a row. The transverse connecting fibres are given off at pretty regular intervals; they are 0·04 to 0·05 mm. in diameter and about 0·6 mm. apart. The spicules are uniserial, and frequently separated by a space equal to their length; there are about four spicules in each fibre. The mesh of the fine dermal network is very irregular, and the inhalent pores are from 0·1 to 0·15 mm. in diameter.

The spicules are sharp-pointed oxea 0·035 to 0·04 by 0·0015 to 0·002 mm.

The specimen described has been identified by comparison with a fragment from the Lendenfeldian collection now in the British Museum. The example referred to was labelled "*Ceraochalina levis*, Lendenfeld, Torres Straits." Both the "Thetis" and the British Museum specimens agree with the description and figure.

There is, however, a second fragment received from the British Museum, which, although labelled *Ceraochalina levis*, Lendenfeld, appears to be quite distinct, and apparently has no resemblance or character by which it could be associated with *C. levis*, Ldf., except that they both possess oxeote spicules, but very different in dimensions. The sponge in question appears to be the one referred to in Lendenfeld's description of *C. levis* as an "algal pseudomorph" from Port Chalmers, New Zealand. I have examined many specimens of this form, in which an alga and a sponge are thoroughly united; there are numerous examples in the Australian Museum from West Australia, New Caledonia, New Hebrides, and Torres Straits. From the data at my disposal I am inclined to the opinion that the true *C. levis*, Ldf., is from Port Chalmers, and that the "algal pseudomorph" is from Torres Straits; at least, it appears so from the distribution of the algal form as given above; all the well-authenticated specimens come from coral regions.

The following is a description of the algal pseudomorph drawn from well-preserved spirit and also dried specimens:—Pseudomorph usually consisting of a series of more or less interlaced, decumbent, and often coalesced branches, which vary from lamellate to cylindric; the latter are usually about 10 mm. in diameter. The surface is smooth, porous, and exhibits numerous scattered oscula from 1 to 1·5 mm. in diameter. In section the algal portion presents an irregular reticulation of filaments. I failed to find any indication of spongin or fibres, but the spicules form a loose and ill-arranged sheath around the delicate branches of the alga. Here and there a few spicules occur in the mesh of the network,

and irregular tufts project at the external surface of the nodes. In every part of the organism the spicules are irregularly disposed and apparently devoid of any trace of spongin. The slender, slightly curved oxeote spicules measure 0·15 mm. in length and are 0·006 mm. in diameter; their size is very different from those of *Ceraochalina levis*, Ldf., derived from the fragment of the type, which are 0·35 to 0·04 mm. in length and 0·0015 to 0·002 mm. in diameter.

Whilst on the subject of the so-called algal pseudomorph, it may be well to state that the colour of *Echinoclathria macropora*, Ldf., described as "a bright madder brown," is due to the presence of a red filamentous alga which ramifies through the whole sponge, including the fibres.

Subfamily RENIERINÆ, *Schmidt.*

RENIERA, *Nardo.*

RENIERA DENDYI, *Whitelegge.*

Reniera dendyi, Whitelegge, Rec. Austr. Mus., iv., No. 2, 1901, p. 67, pl. x., fig. 1.

Station 15.

A small example was obtained off Norah Head in 32-48 fathoms.

GELLIUS, *Gray.*

GELLIUS REPTANS, *sp. nov.*

Station 54.

Sponge encrusting, about 10 mm. in height, and indefinite in extent, growing on a papyraceous worm tube. Surface covered with a delicate reticulated epidermis, with numerous small pores and a few scattered oscula about 0·5 mm. in diameter. Colour dirty cream. Texture bread-like and friable.

Skeleton composed of loosely arranged whisps of spicules, without perceptible spongin. The bundles of spicules in the denser part of the sponge may have about twelve or more in an irregular row. At the surface the spicules are ill-arranged, but in some parts there is a tendency towards more definite order, forming a subquadrate or a triangular mesh, the size of the latter being governed by the length of the spicules.

Megascleres :—straight or rarely curved strongyla with evenly rounded ends, perfectly cylindrical, and devoid of any tendency to an oxeote character. Size 0·16 mm. by 0·006 mm.

Microscleres :—simple C-shaped bodies about 0·014 mm. long ; they are few in number and difficult to find.

This species differs from other members of the genus in its peculiar spicular characters both as regards shape and size.

RAPHISIA, *Topsent.*

RHAPHISIA RAMOSA, *sp. nov.*

(Plate xliii., fig. 4.)

Station 44.

Sponge consisting of a number of coalescent branches with from three to four longitudinal grooves. The branches are somewhat contorted and vary considerably in length ; the longest are about 70 mm. and the shortest 50 mm. The diameter of the branches ranges from 5 to 10 mm. Each branch exhibits several longitudinal grooves in which are situated a few irregular oscula (?) from 2 to 5 mm. in diameter, and the surface generally is more or less finely porous.

The skeleton is somewhat complicated and difficult to diagnose, inasmuch as the real arrangement of the spicules is obscured by a peculiar cellular covering which resembles some of the unions between an alga and a sponge.

In sections mounted in glycerine the sponge presents features which are like those of the sponge and the alga combined, yet the latter is so indefinite that it is difficult to say whether it is part of the sponge or an alga.

On the other hand, in sections mounted in Canada balsam the algal features are obscured and the spicular characters are rendered distinct, but the cellular elements present—in the form of the cell walls—tend to the impression that there are irregularly shaped microscleres scattered throughout the body of the sponge.

Thin longitudinal sections mounted in glycerine present a subcontinuous surface, with here and there dense cellular looking fibres which form a close but irregular network of primary and connecting branches, the inclosed spicules being barely visible except where they are exserted. Similar sections mounted in Canada balsam exhibit the disposition of the spicules ; they form loose whispy bundles which run more or less longitudinally with rather indefinite connecting branches and an abundant supply of scattered spicules throughout the ground substance.

The spicular fibres are about 0·1 mm. in diameter and from 0·1 to 0·2 mm. or more apart. The mesh of the network is generally oblong, but very indistinct.

Megascleres:—oxea of two sizes—(1) 0·4 to 0·5 mm. by 0·01 mm., (2) 0·1 by 0·004 mm. Both forms are straight and abruptly sharp pointed.

Microscleres:—fine trichodragmata about 0·15 to 0·2 mm. in length; they are chiefly arranged in bundles.

Subfamily GELLIODINÆ.

GELLIODES, *Ridley.*

GELLIODES POCULUM, *Ridley and Dendy.*

Gelliodes poculum, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 48, pl. x.; Lendenfeld, Austr. Mus. Cat. xiii., Sponges, 1888, p. 189.

Station 44.

A single example of this species was obtained off Coogee, at a depth of 49-50 fathoms.

CHONDROPSIS, *Carter.*

CHONDROPSIS SYRINGIANUS, *sp. nov.*

(Plate xliii., fig. 1.)

Station 53.

Sponge consisting of a short thick peduncle and a series of tubular branches from 50 to 250 mm. in length and from 10 to 40 mm. in diameter, total height nearly 300 mm., larger diameter 190 mm., smaller about 100 mm. Externally the surface is somewhat uneven, the branches exhibit from four to six rounded nodes and a few low blunt elevations. Internally the tubes are lined with numerous oscula from 2 to 3 mm. in diameter. The tubes commence immediately above the peduncle and gradually increase in diameter to within a short distance of the somewhat contracted summits; the latter are bordered by a delicate membraneous margin which in the living sponge was probably highly contractile; their diameter is usually about 25 mm. General surface closely reticulate, finely porous, and minutely conulose. The mesh of the dermis varies from 0·5 to 1 mm. in diameter, and the fibres of the network are rather coarse and plainly visible to the unaided eye.

Texture rather tough and somewhat elastic. Colour yellowish grey.

Skeleton consisting of an intricate network of stoutish primary and secondary fibres, charged with foreign spicules and a few sand grains. The connecting fibres are somewhat ill-defined, being composed of spicules proper to the sponge. The dermal, subdermal and choanosomal regions are also amply provided with strongylote spicules manufactured by the sponge.

Primary fibres 0·2 to 0·25 mm. in diameter; secondaries from 0·05 to 0·1 mm., and the slender connecting fibres vary from 0·001 to 0·02 mm. The mesh of the network is generally oval or oblong and is usually about 0·5 in the shorter diameter. The spicules consist of strongyla 0·13 to 0·15 mm. in length by 0·0055 mm. Sigmata and chelæ of various kinds have been observed, but I failed to find any microscleres that could be regarded as proper to the sponge. This species undoubtedly presents features which link it with the genus *Chondropsis*, yet it appears to have lost its microscleres or to have selected such a quantity of foreign ones that the spicules of its own make are undistinguishable from those of other sponges. C- and S-shaped microscleres are present on the dermal surface as well as in the body of the sponge, but these are so irregular in shape and disposition that I cannot regard them as spicules secreted by the sponge.

CHONDROPSIS LAMELLA, *Lendenfeld, sp.*

Phoriospongia lamella, Lendenfeld, Austr. Mus. Cat. xiii., Sponges, 1888, p. 194.

Station 53.

One fine example off Crookhaven River, at a depth of 23 fathoms.

CHONDROPSIS KIRKII, *Carter, sp.*

Dysidea kirkii, Carter, Ann. and Mag. Nat. Hist., (5), vii., p. 374.

Sigmatella australis, Lendenfeld, Austr. Mus. Cat., xiii., Sponges, 1888, p. 195.

Sigmatella corticata, Lendenfeld, Austr. Mus. Cat., xiii., Sponges, 1888, pp. 195-199; *Id.*, Mon. Horny Sponges, 1889, pp. 613 and 618.

Stations 48, 59.

Two specimens were obtained, one off Wollongong and the other off Narrabine. Depth 30 to 56 fathoms.

Subfamily PHLŒODICTYINÆ, *Carter.*

RHIZOCHALINA, *Schmidt.*

RHIZOCHALINA PUTRIDOSA (? *Lamarck*).

? *Alcyonium putridosum*, Lamarck, Mem. Mus. Hist. Nat. Paris., i., p. 168.

Rhizochalina putridosa, Ridley and Dendy, Chall. Rep., Zool., xx., p. 33, pl. viii., figs. 5-5*a*, pl. ix, figs. 1, 7.

Station 34.

A single example of this species was obtained off Port Jackson in about 39 fathoms. The specimen is subglobose and measures 100 mm. All the fistula when perfect are rounded at the summit and minutely porous. The fitulose processes vary from 5 to 70 mm. or more in height. The surface generally is more or less obscured by growths of Bryozoa, Gorgonia, Hydroid Zoophytes and other sponges. The spicules consist of slightly curved oxea Size about 0·195 by 0·014 mm.

Family POECILOSCLERIDÆ, *Topsent.*

Subfamily ESPERELLINÆ, *Ridley and Dendy.*

ESPERELLA, *Vosmaer.*

ESPERELLA ANCORINA, *sp. nov.*

(Plate xliii., fig. 3.)

Station 36.

Sponge palmo-digitate with a well defined stalk and numerous irregular branches; the latter vary from 30 to 230 mm. in length and from 15 to 25 mm. in diameter: they are compressed in their proximal half and subcylindrical distally; the summits are either rounded or obliquely truncated. The surface generally is minutely wrinkled and slightly wavy; towards the apices of the branches there are numerous small conuli about 0·5 to 1 mm. in height; the tips of the branches exhibit a few shallow depressions. The dermal surface is finely porous; the oscula are scattered, substellate—about 1·5 or 2 mm. in diameter—and mostly confined to one side of the sponge; a few are indicated on the longest branch on the right hand side of the figure.

Texture firm and fairly resilient. Colour dull dark cream.

The skeleton consists of a rather open network of dense spicular fibres with very little visible spongin. The mesh varies in shape from subcircular to oblong, and usually measures, between the primary fibres, from 0·8 to 1 mm. in diameter. The main fibres are densely packed with stylote spicules and are from 0·2 to 0·4 mm. in thickness; the secondary and connecting fibres consist of whispy bundles from 0·5 to 1 mm. in diameter; there are also many spicules in the ground substance and also echinating the fibres, but in a most irregular manner.

Megascleres:—styli very variable in thickness, but usually about 0·4 mm. in length; they are subfusiform and gradually sharp-pointed.

Microscleres:—consist of three sizes of anisochelæ, two of which are arranged in rosettes. The larger clusters are about 0·25 mm. or more in diameter and the smaller 0·1. The individual spicules of the former have three grapnel-like teeth, a curved shaft with a peculiar grooved head. The shape and general contour is exactly like a spicule figured by Bowerbank from West Australia.* The smaller rosette spicules are similar in shape to larger kind, but the teeth are either absent or rudimentary.

The third kind of anisochelæ is somewhat like a C about 0·02 mm. long with a short hook at the apex and a slightly longer one at the base; the latter is almost straight, with its apex pointing towards the upper part of the C. These peculiar spicules are scattered throughout the body of the sponge.

ESPERELLA CYLINDRICA, *sp. nov.*

(Plate xliii., fig. 8.)

Station 44.

Sponge consisting of a cylindrical stem 300 mm. in length and from 10 to 20 mm. in diameter. The specimen is a washed-out example denuded of its epidermis and retaining but little of its sarcode. The external surface is minutely conulose, rather openly reticulate, and presents a series of depressions about 5 mm. deep and 15 mm. apart; these appear to be the oscular areas. Texture resilient, rather tough. Colour light-sponge. The skeleton has a radiate appearance when viewed by transmitted light, the central fibres of the axis can be traced for a considerable distance and finally they terminate in tufts at the surface.

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* Bowerbank—Mon. British Spongidæ, i., 1864, p. 249, pl. vi., fig. 135.

The primary fibres consist of compact bundles of spicules imbedded in a moderate amount of pale spongin; usually they are about 0·1 mm. in diameter; the secondaries are multispicular, and measure from 0·05 to 0·07 mm.; the connecting fibres and those of the surface are slender, with two or three spicules in a row, and vary from 0·02 to 0·04 mm. in thickness. Mesh rather open, either oblong or subrectangular, and usually about 0·5 to 0·8 mm. in width.

Megascleres:—straight, styli cylindrical to within about 2 diameters of the not very acute extremity; size 0·2 by 0·0075 mm.

Microscleres:—palmate anisochelæ, 0·032 mm. long and 0·01 mm. wide; the lateral processes at both ends of the spicule are well developed, and generally they closely resemble the anisochelæ of *Esperella lapidiformis*, Ridley and Dendy.* One example obtained off Coogee, 49-50 fathoms.

ESPERELLA TEXTILIS, *sp. nov.*

(Plate xliii., fig. 2).

Station 44.

The single example forms a subflabellate expansion 200 mm. high and 120 mm. wide, and from 30 mm. to 40 mm. in thickness. The sponge consists of a very open network of densely spicular fibres, with little obvious spongin; the primaries give off a series of secondaries at pretty regular intervals of about 5 mm., these are united here and there with the somewhat irregularly disposed connecting fibres; the whole forming a loosely arranged network, the mesh of which is usually square or slightly oblong. The dermal surface presents a beautiful appearance to the unaided eye, like that of some delicate network or textile fabric. The specimen is a dried one and does not exhibit anything definite in the way of distinct pores or oscula. The main fibres consist of compactly-arranged spicules, and vary from 0·5 to 1 mm. in diameter; the branches are about 0·25 mm., and the dermal and connecting fibres range from 0·05 to 0·1 mm., whilst some of the finer cross fibres consist of one or two spicules in a row. The texture of the specimen is rather brittle and the colour white or grey.

Megascleres:—subtylostyli, with fusiform shaft, acutely pointed at the base and evenly rounded at the apex, with a perceptible constriction about two diameters below the summit. Size 0·55 mm. by 0·01 to 0·014 mm.

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* Ridley and Dendy—Chall. Rep., Zool., xx., 1887, pl. xv., fig. 10-10a.

Microscleres:—palmate anisochelæ, always arranged in rosettes about 0·11 mm. in diameter; the individual chelæ measure 0·05 mm. in length and 0·015 mm. in breadth. The teeth on the upper part are fairly distinct; the lower blade, however, has its apices truncated, the shaft has a clear space of about 0·015 mm. in length. There are a few C-like spicules about 0·15 mm. in length, and abundant smaller ones which measure 0·015 mm.

ESPERELLA MURRAYI, *Ridley and Dendy.*

Esperella murrayi, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 67, pl. xiii., figs. 11, 13, 14, 16, 17, 18, pl. xiv., figs. 1-1*a*.

Station 34, 36.

The "Thetis" collection contains six examples of this interesting species obtained off Port Jackson and Botany in from 20 to 39 fathoms.

Five of the specimens are pretty equal in size and measure 100 mm. in height and from 30 to 40 mm. in diameter. The largest example is nearly 200 mm. in height and 130 mm. broad, and from 25 to 40 mm. in thickness. In shape it is subflabellate, with one surface concave and the other convex; the latter exhibits traces of four coalescent lobes which are more marked at the apical border. Judging from the appearance of the specimens, it appears that the outer surface—in the living sponge—is highly contractile. The surface generally presents a series of scale-like plates, which evidently play an important part in the inhalent currents taken in by the sponge.

The action of these plates appears to be valvular; each plate is margined by a thin membraneous edge which, when drawn down tight, effectually closes the so-called cracks or grooves. On the other hand, when the plates contract, the membraneous margins are elevated, and expose to view a series of fine thread-like fibres, connected by a neatly perforated membraneous web. Beneath this intricate trellis structure there exists a complicated series of canals with numerous pores from 0·5 to 1 mm. in diameter. In addition there are many larger openings from 2 to 3 mm. in diameter, and 4 or 5 mm. apart. These are in keeping with the size of the oscula, and I feel inclined to regard them as such, rather than inhalent pores. It will thus be seen that the various scale or plate-like bodies on the surface have the power by contraction to close the whole of the inhalent system at will, and if the larger openings are oscular in function the exhalent currents are also under control by the contractility of the peculiar epidermal layer. The summit of the sponge in the large specimen presents about forty oscula, all of which are closed by contraction

each one forms a distinct cone about 3 or 4 mm. in height, the sides exhibit a series of puckered ridges, indicating that the sponge possessed great powers of contraction, especially as far as the dermal surface is concerned. In the smaller examples the surface does not exhibit many grooves or plates; in fact, in one or two cases the epidermal layer is quite smooth, and exhibits only the faintest trace of a groove here and there. The oscula are practically invisible to the unaided eye, and can only be demonstrated by partially drying and then immersing in spirit; the oscula can then be located by the bubbles which issue from them.

The spicular characters agree with those given by Ridley and Dendy. I have failed to find other megascleres than those described in the type of *E. murrayi* by Ridley and Dendy. Tylostyles and subtylostyles are apparently absent. Carter's *Esperia placoides* was obtained in 345 fathoms off the Shetland Islands.

Topsent* records the same species from Newfoundland from a depth of about 600 fathoms.

Judging by the spicular characters and the difference in depth at which *E. murrayi* and *E. placoides* occur I regard them as quite distinct species, and they might be so regarded until a comparison of the types has been made.

ESPERIOPSIS, *Carter.*

ESPERIOPSIS CYLINDRICA, *Ridley and Dendy.*

(Plate xliii., fig. 6).

Esperiopsis cylindrica, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 79, pl. xix., fig. 2, 2*a*, 2*b*.

Stations 41 and 48.

About twenty specimens of this species were obtained off Wata Mooli and Wollongong in from 52 to 71 fathoms. The larger examples measure about 300 mm. in height and about 200 mm. in diameter; the main peduncle varies from 50 to 100 mm. in length, and is usually about 10 mm. in diameter. The megascleres agree with the original diagnosis; the microscleres are represented by abundant toxa, varying greatly in size and curvature; they range from 0·5 to 1 mm. in length. The chelæ are fairly scattered throughout the sponge, and rarely exceed 0·014 in length.

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* Topsent—Résultats Campagnes Sci. Albert 1er, Monaco, Fas. ii., 1892, p. 89.

ESPERIOPSIS CANALICULATA, *sp. nov.*

(Plate xliii., fig. 7).

Stations 41, 47, 48.

Sponge stipitate, much branched, and here and there coalescent. The branches are subcylindric or slightly compressed proximally in the plane of branching, and the distal two-thirds of each exhibits a very distinct longitudinal groove which terminates at the summit.

The surface generally is covered with a tough leathery-looking epidermis without any visible pores. The oscula, if present, are closable and situated at the apices of the grooves; there are several branches which exhibit a slightly puckered depression at the summit, but no distinct opening that might be termed a vent. In worn examples the channels in the branches exhibit a series of subdermal pores about 1mm. or less in diameter. Texture firm, somewhat resilient; colour yellowish-grey.

The skeleton when denuded presents a *Raspailia*-like surface, but the network is reticulated. The mesh is generally oblong or oval, and the axial region is occupied by several stout multispicular fibres; the latter give off numerous secondaries which are rather peculiar in shape; they are broad at their origin, contracted in the middle, and expanded at their extremities, forming a kind of rosette-like structure, which supports the epidermis; when the latter is removed the projecting ends of the fibres give the surface a peculiar bristly or villose aspect. The thickened epidermal layer is furnished with numerous closely-arranged radiating spicules; when viewed from above many very small pores can be seen between the tufts of surface spicules.

The primary and secondary fibres consist of dense bundles of spicules about 0·2 mm. thick; they are closely packed in a thin layer of pale yellow spongin; the connecting fibres are very indefinite and consist of whispy masses of spicules, which extend from the stouter fibres. The mesh measures from 0·5 to 1 mm. in length, and is usually about 0·2 or 0·3 mm. in diameter. The dense layer of epidermal spicules is 0·25 mm. in thickness.

Megascleres:—straight smooth styli, variable in length and diameter, the largest 0·5 by 0·001 mm., medium stouter kind 0·35 by 0·0018 mm.; styli of the epidermis 0·15 by 0·006 mm. Some are subtylostyli with a very slight oval head.

Microscleres:—minute isochelæ 0·0014 mm. long, and toxa with a well marked median bend about 0·02 mm. long. There are also a number of straight toxodragmata present.

ESPERIOPSIS FERRUGINEA, *sp. nov.*

(Plate xlv., fig. 26.)

Station 48.

Sponge consisting of a series of angular coalescent branches, about 5mm. in diameter, forming a clathrate mass with an open subhoneycombed surface. Texture tender, brittle and inelastic. Colour like rusty iron, with the tips of the minute conuli white or grey. The conulose ridges are low, irregular, and enclose a series of variously shaped lacunæ from 0·5 to 1·5 mm. or more in diameter, the edges of which are fringed with a few small conuli.

The main fibres consist of bundles of loosely arranged spicules about 0·15 mm. in diameter. The secondaries and connecting fibres are very indefinite, embracing a few ill arranged whispy lines of spicules, disposed in multi- or unispicular rows; the mesh is coincident with the length of the spicules, and is more or less rectangular, but somewhat obscured by the numbers of scattered spicules in the choanosome.

Megascleres:—straight styli or subtylostyli of various sizes from 0·2 to 0·35mm. in length and from 0·008 to 0·015 mm. in diameter.

Microscleres :—rather stout isochelæ with a curved shaft and three well developed teeth on each end ; length about 0·03 mm.

PSEUDOHALICHONDRIA, *Carter.*

PSEUDOHALICHONDRIA FIBROSA, *Whitelegge.*

Pseudohalichondria fibrosa, Whitelegge, Rec. Austr. Mus., iv., pt. 2, 1901, pp. 78 and 117, pl. x., fig. 8.

Station 53.

A fine specimen of this species was obtained off Crookhaven River in 23 fathoms The example measures nearly 300 mm. in height and has five main branches, all of which are more or less coalescent; the stem is 80 mm. long and 10 mm. in diameter. The branches are flattened—in the plane of branching—and each presents one or more well marked longitudinal grooves; on the lateral branches the grooves are continued from the base of the peduncle to the much compressed and somewhat dilated apices.

Epidermal surface glossy, with conical projections about one or two mm. apart. The grooved areas are depressed, and have microscopic transverse corrugations—these are probably due to the contractile nature of the dermal membrane—overlaying the well defined grooves. Pores, if present, are so contracted as to be

invisible even with the aid of a lens ; here and there oscula-like apertures are present, but it is difficult to say whether they are true oscula or accidental perforations ; the tips of the branches are provided with vents, but it is only by cutting sections that they can be demonstrated.

AMPHILECTUS, *Vosmaer.*

AMPHILECTUS CERATOSUS, *Ridley and Dendy.*

Amphilectus ceratosus, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 125, pl. xix., fig. 10-10*a*, pl. xxv., fig. 2, pl. xlvii., fig. 2.

Station 36.

A single example of this interesting species was obtained off Botany Bay at a depth of 23 fathoms. The specimen is subflabellate and attached to the stem of a Gorgonia. It measures 50 mm. in height, 35 mm. in breadth, and from 15 to 20 mm. in thickness. The dermal surface is smooth and very finely porous, the pores being confined to certain areas, and are pretty evenly distributed. Vents numerous, scattered, about 1 mm. or less in diameter.

The skeleton agrees with Ridley and Dendy's description, and it may be added that in the sections examined some of the stouter fibres are dilated and form a kind of trellis, and have scattered sand grains both in the fibres and enclosed in the mesh of the reticulation. The presence of sand grains in the main fibres lends support to the idea—suggested in the remarks following the description—that the horny skeleton is that of a *Euspongia* over which the spicule-bearing sponge has grown.

The spicules agree with those of the type.

CLADORHIZA, *Sars.*

CLADORHIZA WAITEI, *sp. nov.*

(Plate xliv., figs. 13, 13*a*.)

Stations 36, 44.

Some eight or ten examples of this interesting form are in the collection, and in most cases they are on the stems of dead Gorgonias; in some specimens they form a coating around a long simple stem, in others they cover a series of complicated branches. The space between the branches is frequently bridged over by more or less

continuous sponge substance. The surface generally is furnished with abundant conuli about 5 mm. high and from 2 to 3 mm. apart. The conuli are more or less connected by narrow ridges; the depressions between are deeply concave and are often triangular in outline, with a tendency here and there to form interrupted longitudinal grooves. The dermal surface is slightly rugose, finely porous, with a few scattered oscula which are generally situated in the depressions.

Skeleton consisting of a series of densely packed cylindrical fibres of stylote spicules. The diameter of the main fibres ranges from 0·2 to 0·3 mm.; the secondaries are about 0·1 mm., whilst the connecting fibres are diffused and consist of bands of ill arranged spicules. The mesh is more or less rectangular and usually about 0·5 mm. or more in diameter. The primary and secondary fibres terminate at the surface in numerous aculeations. Each fibre is invested with scattered C-shaped spicules, and the latter, together with the anisochelæ and styli, are abundant in the choanosome and also in the dermal membrane.

Megascleres:—fusiform styli with occasionally a few subtylostyli 0·35 to 0·4 mm. long by 0·015 mm. in diameter in the centre of the spicule.

Microscleres:—sigmata either contort or C-shaped, usually the latter are the most noticeable; size 0·15 by 0·08 mm. Anisochelæ 0·045 mm. in length; the flukes are about 0·025 by 0·01 mm. and the shaft 0·015 mm. long.

PHELLODERMA, *Ridley and Dendy.*

PHELLODERMA POLYPOIDES, *sp. nov.*

(Plate xliv., fig. 12).

Station 36.

Sponge with a short broad stem attached to fragments of shells; the distal third or half presents a series of five finger-like processes from 30 to 50 mm. long and 5 or 10 mm. in diameter; the larger branches are somewhat flattened and taper gradually to subacute points, which are apparently osculiferous.

Dermal surface somewhat rugose and furnished with numerous minute dome-shaped elevations; the latter give the sponge an appearance like that of an Alcyonarian coral with retracted polyps. The elevations are darker in colour than the ground, and are about 0·5 mm. in diameter and 1·0 mm. or more apart.

Texture close, hard, and rather tough. Colour mottled-brown.

The skeleton consists of wavy, radiating bundles of spicules from 0·2 to 0·4 mm. in diameter. The main fibres are longitudinally arranged and give off a series of secondaries which terminate in whispy clusters near the surface. The areas of elevation are surrounded by a vast number of spicules, which are disposed in a radiate manner, and probably act like a valvular arrangement for closing or opening the apical pore.

The dermal membrane is supported by the radiating pillars of spicules, and has many others irregularly scattered in the choanosome. The epidermis is about 0·5mm. in thickness and is densely packed with isochelæ, many of which are in contact with, or even overlap each other; they are rarely more than their length apart.

Megascleres:—straight, smooth, slightly fusiform styli, with acute points and a well rounded, but tapering base; size, 0·6 to 0·7 mm. long by 0·0065 to 0·007 mm. in diameter.

Microscleres:—these consist of strongly bent isochelæ, each end with three subequal teeth; they are extremely abundant in the dermis, and either in tracts or scattered rather sparsely in the choanosome; size from 0·025 to 0·03 mm. This species differs in many characters from the type of the genus, viz., in habit, and the larger spicules, which are quite smooth, without any tendency to become polytylote.

DESMACIDON, *Bowerbank.*

DESMACIDON PORIFERA, *sp. nov.*

(Plate xliii., fig. 5.)

Stations 34, 44, 36.

Sponge stipitate, much branched, and here and there coalescent. The branching is mostly lateral, rarely dichotomous. Main peduncle 10 mm. in diameter and from 60 to 90 mm. in length; it exhibits numerous short, more or less prominent angles arranged longitudinally. The branches are angular and subparallel, they are from 5 to 8 mm. in diameter and from 90 to 200 mm. or more in length; at or near their origin they are abruptly curved upwards. The surface generally is very porous, the pores varying in size from 0·1 to 0·2 mm. in diameter. Oscula numerous, prominent, and usually surmounting the angles on the peduncle and branches. Their diameter varies from 1 to 2 mm., and they are from 4 to 6 mm. apart. Skeleton composed of a rather open reticulation of fibres; the primaries traverse the central axial region and give off numerous secondaries, which curve outwards,

and terminate at the surface in a complex network. The main fibres are composed of loosely arranged spicules—about 8 or 12 in a row—and are held together by a small amount of horny matter; they are about 0·05 mm. in diameter and 0·25 to 0·3 or more apart. The secondaries have three or four spicules in a row, and the connecting fibres are mostly unispicular.

The mesh is square or oblong; near the surface it becomes somewhat irregular, and the mesh is regulated by the length of the spicules. The latter consist of oxea of two sizes, 0·14 by 0·013 mm., 0·11 by 0·004 mm. Slightly curved bidentate chelæ are present in moderate quantities; size 0·016 mm.

DESMACIDON HISPIDOSA, *sp. nov.*

(Plate xliv., fig. 17.)

Station 44.

Sponge with a well developed attachment base; the main axis is 140 mm. high and gives off three or four lateral branches, some of which are coalescent; all are more or less compressed in the plane of branching, except at the tips, and measure about 5 or 10 mm. in their greater and from 3 to 7 mm. in their lesser diameter. The primaries give rise to a series of secondary branchlets which are in various stages of development. General surface—where the ectoderm is intact—porous and minutely conulose, elsewhere with a strongly hispid aspect and a rather loose or open network of stoutish fibres. Texture firm, tough and scarcely compressible. Colour greyish-brown.

Skeleton consisting of a series of somewhat stoutish primary fibres, which are centrally plexoid, and give off at irregular intervals many secondaries, and as the surface is approached they terminate in subradiating tufts of fine fibres in the ectosome and form some of the minute conuli as well as giving the denuded surface its hispid appearance; the connecting fibres are very slender, numerous, and render the description of the network or mesh difficult; disregarding the finer fibres, the mesh may be described as rhomboidal, oblong, or elongate, each space being occupied by a miniature spider-like web of slender fibres.

Megascleres:—straight or slightly curved oxea, cylindrical to within about three or four diameters of the acute points; these spicules are densely packed in the main fibres; in the secondaries they are biserial, and in the finer fibres mostly uniserial or absent. Size from 0·18 to 0·2 mm. by 0·008 mm. to 0·01 mm.

Microscleres:—sigmata very variable in size and shape, ranging from 0·015 to 0·12 mm. in length; they are abundant throughout the sponge. Chelæ have not been observed.

DESMACIDON STELLIGERA, *sp. nov.*

(Plate xliv., fig. 11.)

Station 53.

Sponge flabellate, about 270 mm. high, 130 mm. broad, and from 5 to 10 mm. in thickness. The frond is divided into two portions; the larger is lanceolate and lobate on the margins, especially near the summit; the smaller portion is ligulate and about 35 mm. wide. Both originate from a slightly thickened and highly conulose stem about 30 or 40 mm. in diameter and 30 mm. high. The base of attachment is flat and well defined, but not enlarged. The surface presents in the depressions a smooth non-porous dermis, but where this is eroded it is closely covered with more or less oblong pores about 0·5 mm. in width and 1 or 2 mm. in length; they have a tendency to become radiate, and give the surface an appearance quite peculiar and characteristic of the species. The elevations vary from 2 to 8 mm. in height, and consist of a series of oscula openings in groups of three or more. The latter are surrounded by numerous radiating grooves which extend to a distance of 10 mm. or more from the central oscular bearing elevations, some of which on the unabraded parts are covered with membrane, and it appears probable that this would be valvular in its action and to some extent regulate both the inflow and outflow of water. Texture hard and tough, scarcely compressible between the fingers. Colour dull yellowish-grey.

Skeleton consisting of a complicated network of stout fibres with usually a more or less rounded mesh. The main fibres are enveloped in a fair amount of spongin, and their diameter is usually about 0·25 to 0·3 mm. The core consists of a dense mass of chiefly broken spicule fragments, probably of foreign origin; the latter appear to be ensheathed with proper oxeote spicules, many of which are embedded in the fibres by their basal third and stand out nearly at right angles to the fibre, so as to appear as echinating spicules; their oxeote form, however, appears to preclude such being the case. The secondaries are 0·1 mm. in diameter and consist of closely packed oxea; the connecting fibres are composed of a few diffuse spicules, and rarely exceed 0·5 mm. in diameter.

Megascleres:—straight or but slightly fusiform oxea with moderately sharp points. Size in the fibres 0·17 by 0·001 mm.; the dermal spicules are somewhat shorter and a little stouter.

Microscleres:—sigmata both simple and contort. Size from 0·05 to 0·07 mm. long.

Small isochelæ 0·013 mm. long. Both kinds of spicules are fairly abundant.

This species closely resembles *Desmacidon* (*Homœodictya*) *grandis*, Ridley and Dendy,* but differs in most of its internal characters from the African species.

DESMACIDON (?) ARENOSA, *sp. nov.*

(Plate xliv., fig. 10.)

Station 54.

Sponge massive and bread-like in appearance, growing between the roots of a seaweed (*Ecklonia radiata*, J. Ag.). The specimen measures 70 mm. by 45 mm. and is about 30 mm. in height. Surface covered with numerous small pores from 0·05 to 0·1 mm. in diameter. The apparent oscula are irregularly scattered over the sponge, and are usually 2 or 3 mm. across. A number of larger apertures are also present, but these I regard as the work of a boring Isopod. Texture firm but brittle. Colour when fresh light terra-cotta ; in spirit or dried, yellowish-grey.

Skeleton consisting of an intricate network of colourless fibres, charged with sand grains and fragments of the spicules of other sponges. The foreign materials in the fibres have a peculiar feature, inasmuch as they are usually quadrate or slightly oblong with sharp angles. The main fibres are about 0·15 mm. or 0·2 mm in diameter, but here and there they are irregular, somewhat nodose, and contracted or expanded according to the position in the network. The secondaries and connecting fibres are very indefinite and rarely exceed about 0·5 or 1 mm. in diameter.

Megascleres :—probably absent ; one or two tylota were observed, but they might be of foreign origin.

Microscleres :—small isochelæ, with the shaft straight or rarely curved, and each end is provided with three or more teeth. Size about 0·015 mm. When viewed from above the spicules appear to be like those of *Iotrochota*, but when seen from the side the teeth are evidently confined to one side of the axis. *Desmacidon chaliniformis*, Carter, has microscleres of the same kind, but they are somewhat smaller, and the horny matter of the fibres is much more abundant.

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* Ridley and Dendy—Chall. Rep., Zool., xx., 1887, p. 111, pl. xxii., pl. xxix., figs. 7-7*a*.

DESMACIDON FRUTICOSA, *Montagu*, sp.

(Plate xliv., fig. 14.)

Stations 44, 48, 53.

Spongia fruticosa, Montagu, Mem. Wern. Soc. Edinb., ii., 1818, p. 112, pl. xiv., figs. 3, 4.

Halichondria fruticosa, Johnson, British Sponges, 1842, p. 103.

Desmacidion fruticosa, Bowerbank, Mon. British Spongidæ, i., 1864, p. 200.

Desmacidon fruticosa, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 104, pl. xxiii., figs. 10, 10*a*, 10*b*, 10*c*, 10*d*, pl. xxx., fig. 1.

The figured specimen measures over 200 mm. in height and is about 140 mm. in diameter. The branches are very numerous, and every branch on the frontal aspect presents a deep, well marked groove extending from base to summit. The grooves are from 5 to 10 mm. in width and about the same in depth; their inner surfaces are pretty fairly sprinkled with pores, generally about 2 or 3 mm. in diameter, but often larger. Ridley and Dendy* appear to be doubtful as to the nature of the grooves and wonder whether "these grooves are natural or whether they have been caused by the sponge growing up against some cylindrical branching organisms."

Judging from the specimen, the grooves in life were covered by a perforated membrane, as in many other deeply grooved sponges.

DESMACIDON CONULISSIMA, *sp. nov.*

(Plate xliv., fig. 16.)

Station 53.

Sponge usually consisting of a more or less fused mass of angular branches; each branch exhibits numerous elongate, shallow depressions. The latter are bounded by acute ridges, which are longitudinally disposed and terminate in one or more slender conuli from 5 to 10 mm. in height; occasionally the conuli are much divided at the apices. The specimen figured is a waterworn example, and exhibits fewer conuli than many other examples obtained at Coogee, Maroubra and Long Bay.

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* Ridley and Dendy—Chall. Rep., Zool., xx., 1887, p. 104.

Texture resilient, fairly tough. Colour yellowish-grey. In washed out specimens the fibres have a silk-like appearance.

The dermal surface is unfortunately denuded in all the examples available; subdermally it is highly porous throughout and exhibits numerous oscula having a series of circular apertures—about 1 mm. in diameter— arranged in clusters of three or more, with radiating grooves in which are situated a number of pores of various sizes.

Skeleton consisting of a series of well developed horny fibres; the primaries are arranged longitudinally and are provided with four or more spicules in a row; as they approach the surface they increase in diameter and converge to form the clusters of conuli; here the axial spicules become very numerous and occupy the whole of the fibre. The secondaries are mostly unispicular, whilst the connecting fibres are generally free from spicules. The main fibres measure about 0·15 mm. in diameter, the secondaries 0·5 mm., and the connecting 0·015 to 0·02 mm. The mesh is subquadrangular or oblong and generally about 0·25 mm. wide. The main reticulation is often obscured by numerous slender fibres which are extremely irregular in their arrangement.

Megascleres:—straight or slightly curved oxea, gradually tapering from the middle to acute points. Size 0·17 by 0·01 mm.

Microscleres:—sigmata very variable in shape and size; some are simple, others contort; many examples are C- or U-shaped, with acute ends, which are sharply bent inwards. Size from 0·025 mm. to 0·1 mm. Owing to the washed out condition I have failed to find any chelæ that I could safely say belonged to this form.

This species is allied to *Desmacidon carnosa*, Carter. It is, however, quite distinct, as I have compared the species here described with Carter's type.

Subfamily DENDORICINÆ, *Topsent.*

DENDORYX, *Gray.*

DENDORYX PUMICEA, *sp. nov.*

(Plate xliv., fig. 15.)

Station 47.

Sponge flabellate, growing on the stem of a Gorgonia. The general contour is evidently in keeping with its support; the height is 225 mm., the breadth 140 mm., and the thickness from

5 to 10 mm. The frond-like expansion exhibits a series of lobes and incisions; the former probably indicate the terminal branches of the Gorgonia.

On the basal portion of the sponge the surface is somewhat smooth, with numerous minute pores and a few larger scattered ones which vary from 0·5 to 1 mm. or more in diameter. The upper four-fifths of the surface is ornamented with an immense number of circular or subcircular pores from 0·5 to 3 mm. wide; the pores are seated, as a rule, in well marked grooves and frequently in pairs. The intervening ridges are subradiate, and may be narrow and continuous or occasionally broad and somewhat interrupted by a series of apical pores. Here and there a few oscula-like openings are present, but they are very irregular and appear like the borings of the common Isopod *Cymodoce*. Size of apertures 3-5 mm. Texture hard and rather brittle. Colour yellowish-white, with a slight sheen on the more perfect dermal surface.

Skeleton stellately reticulate, with the blunt ends of the spicules overlapping and forming peculiar nodes like the knots in network. The mesh is more or less triangular in consequence of the star-like arrangement of the spicules. There is no evident spongin present; at least it is quite transparent and undistinguishable with the microscope.*

Megascleres:—straight or but little curved styli wholly spined to within one diameter of the summit; the latter is smooth and usually very acute. Size about 0·2 to 0·22 mm. by 0·01 to 0·04 mm. Fusiform smooth oxea confined to the ectosome and rather scarce. Size 0·18 mm. by 0·07 to 0·08 mm.

Microscleres:—sigmata 0·05 mm., both simple and contort. Tridentate isochelæ 0·025 mm. Both kinds of microsclera are fairly abundant in the membranes surrounding the pores.

DENDORYX FUSCA, *sp. nov.*

(Plate xlv., fig. 20.)

Station 44.

Sponge either massive or consisting of a series of short branches which are often coalescent and form a tangled mass of branchlets; the whole surface is minutely honeycombed, the trabeculæ are interwoven and the apical margins are minutely conulate. The depressions are furnished with deep oval or round pores, from

* See Bowerbank's figure of *Diplodemia vesicicla*, Mon. Brit. Spongidæ, i., 1864, fig, 273.

1 to 3mm. in diameter. Texture when wet very compressible, but in the dried state brittle. Colour brown with a grey tint on the trabeculæ.

Skeleton:—the primary fibres are from 0·5 to 0·1 mm. in diameter, having about twelve or more spicules in a row; the fibres are arranged in a zig-zag manner and are separated by a space equal to the length of the styli; the main fibres present a series of nodes which indicate the origin of the secondary and connecting fibres. The disposition of the spicules at the nodes of the network is very characteristic; the spiny basal portion of each spicule is imbedded in the spongin at every node, and the acutely pointed ends are so arranged as to give a stellate or substellate appearance. The mesh of the sponge between the stouter fibres is usually rectangular, but the reticulation is often obscured by scattered spicules.

Megascleres:—spined styli of two kinds and tornata or bluntly pointed oxea.

(i) Stout spiny styli; the shaft is straight cylindric, with an acute point, spiny base, and a few incipient spines here and there; size 0·2 mm. or under, by 0·01 mm.

(ii) Slender styli; either smooth or with a few spines on the slightly bent base; size 0·2 mm. by 0·006 mm.

(iii) Tornata; size 0·18 to 0·2 mm. by 0·004 to 0·006 mm.

Microscleres:—sigmata both simple and contort; size 0·015 to 0·025 mm. long. Isochelæ rather stout; size 0·022 mm. long.

IOTROCHOTA, *Ridley.*

IOTROCHOTA ARBUSCULA, *sp. nov.*

(Plate xliv., fig. 18.)

Station 41.

Sponge stipitate; stem 75 mm. in length and 10 to 15 mm. in diameter. The base is dilated, subcircular, and about 30 mm. across; the apex gives off a series of five main branches; these at a height of 30 mm. or more bifurcate, and at a distance of from 40 to 80 mm. they again divide. The longer branches measure 240 mm.; at the base they exhibit slight coalescence, and distally they are dichotomously divided, at least three or four times; they are mostly cylindric, but are sometimes compressed, especially in the basal third; the diameter rarely exceeds about 7 or 8 mm.

Dermal surface finely reticulated and porous; the oscula are level with the surface, or in some cases slightly depressed; they consist of circular apertures about 1 or 1·5 mm. in diameter, each of which exhibits a series of six or more sieve-like pores.

Texture hard, tough, and when waterworn resilient. Colour grey, and in appearance very like some species of *Chalinopsilla*.

Skeleton consisting of a rather open network of strongly developed horny fibre; the primaries are about 0·1 to 0·15 mm. in diameter and from 0·25 to 0·5 mm. apart; their course is generally longitudinal, but they are very irregular in outline; this irregularity is probably due to secondary fibres, which are usually short, stout, and about 0·8 to 0·1 mm. in diameter; the slender connecting fibres are not very evident even near the surface. Subdermally the fibres are stoutish and support a highly sandy ectoderm about 0·5 mm. in thickness.

Megascleres:—absent (?); the whole of the fibres are more or less charged with spicule fragments and small sand grains; the materials, probably all of foreign origin, are very loosely arranged, yet they occupy nearly the whole of the fibres. If proper spicules exist they are obscured by the abundance and scattered nature of the sand grains and spicule fragments present.

Microscleres:—birotulates with a straight shaft and equal dentate ends. Size 0·02 mm. long. They are abundantly scattered along the fibres and also throughout the soft parts of the sponge.

YVESIA, *Topsent.*

YVESIA COMMENSALIS, *sp. nov.*

(Plate xliv., fig. 9).

Station 48.

Sponge incrusting, forming a dense blackish-brown villous covering over the whole surface of a Gorgonia (*Parisis australis*, Wright and Studer). The latter authors in describing the Gorgonia state that "they are, however, unfortunately in a very bad state for description, owing to their being overrun by an incrusting sponge, the projecting silicious spicules of which give a roughened appearance to the colony."*

The union between the two forms is so complete that it is difficult to determine either satisfactorily. There are probably

* Wright and Studer—Chall. Rep., Zool., xxxi., 1889, p. 183, pl. xli., fig. 3 (spicules only).

some three hundred examples in the Museum collection obtained at various times, but chiefly by the "Thetis" Expedition, and in every instance the Gorgonoid characters are obscured by the sponge.

Surface reticulated with a series of shallow depressions and low subconulose echinated ridges which have a tendency to form short lines and then to terminate in radiating tufts of spiny styli. The subdermal and internal substance is densely charged with straight cylindric oxea, the extremities of which taper to rather blunt points. Numerous short, sharply bent chelæ, with large flukes nearly meeting in the middle, are present in the choanosome.

Megascleres:—straight or slightly curved spined styli; the apical portion is smooth and very acute; the basal two-thirds bears a series of more or less recurved spines; the base is somewhat truncate and spiny. Size about 0·25-0·3 mm. by 0·015 mm. Oxea 0·19 mm. long by 0·0065 mm.

Microscleres:—short stout isochelæ, 0·015 to 0·02 mm. in length.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 10.—Published 14th August, 1907.

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SPONGES.

PART I.—ADDENDA.

PART II.

BY THOMAS WHITELEGGE,

Zoologist, Australian Museum.

CORRECTIONS.

Page 480—DENDORYX PUMICEA—*after* Plate xliv., fig. 15, *read* and Plate xlv., fig. 24.

Page 245—*for* fig. 20*f*, *read* 23*f*.

Page 441, line 16—*for* pericardial, *read* nephridial.

SPONGES.

By Thomas Whitelegge.

Zoologist, Australian Museum.

Part I.—Addenda.

The new species herein described are as follows :—

Paresperella repens.
Amphilectus munitus.
Dendoryx mirabilis.

PARESPERELLA, *Dendy.*

PARESPERELLA REPENS, *sp. nov.*

(Plate xlv., fig. 22.)

Station 44.

Sponge incrusting and more or less permeating the whole substance of *Dendoryx fusca*, Whitelegge. Characters as usually afforded to the naked eye or to a hand lens are wanting, and it is only by sections of the sponge (*Dendoryx*) that the organism can be localized under the microscope. Notwithstanding its want of definite form it is quite evident and distinct in every section examined. The union between the two sponges is so complete that it is impossible to obtain a section of the *Dendoryx* without abundant traces of the *Paresperella*. The spicular characters of the latter are sufficiently definite and distinct to warrant a description of it as a new species.

The choanosome is rather dense and pale yellow in colour; it is fully charged with tylota or tylostyli, serrated c-shaped spicules and anisochelæ of two kinds, one large—always arranged in rosettes—the other small, and scattered throughout the sponge.

The skeletal characters are rather indefinite, but usually there are indications of fibres consisting of five or six spicules in a row, the rest are radiate or scattered through the body with the apical portion of the spicules directed inwards.

Megascleres :—tylota or tylostyli narrowly fusiform with more or less elongate oval ends; the apex is often furnished with two or three short spines, but usually both ends are evenly rounded. Size :— 0·35 to 0·37 by 0·006 mm.

Microscleres :—anisochelæ of two sizes, the larger kinds are arranged in rosettes, the smaller are scattered.

Sizes :—0·038 and 0·01 mm. Serrated c-shaped spicules with three teeth, directed backwards. Size 0·06 mm.

This species differs from *P. serratohamata*, Carter, in the size of the spicules and in wanting the curved toxa.

AMPHILECTUS, *Vosmaer.*

AMPHILECTUS MUNITUS, *sp. nov.*

(Plate xlvi., fig. 40.)

Station 36.

This form is commensal, living in close association with, and completely investing a gorgonoid colony of the family Cornularidæ—probably a species of *Sympodium* (?). The spicules are similar to those of *S. verrilli*, as figured by Wright and Studer*. The skeletal portion consists of a hollow cylindrical tube of closely packed spicules. The main stem gives off several lateral branches which are disposed in a plane. These develop lateral polyp buds which form low dome-shaped elevations along the branches. Each elevation has a small circular aperture at the summit. These apertures, although oscula-like, are really the openings through which the polyps become expanded.

The example is 120 mm. in height, and the branches vary from 35 to 75 mm. in length and from 5 to 10 mm. in diameter. The sponge forms an even coating over the whole of the gorgonoid, and is about 1 mm. in thickness. The surface generally is like that of some species of *Suberites*, and is marked by a very fine reticulation, and innumerable minute pores. There is no evident epidermis—at least it is not revealed even with a hand lens—and I failed to find any oscula unless the polyp apertures be regarded as such. Texture slightly resilient but rather brittle. Colour bluish-grey.

The skeleton consists of stoutish bundles of stylote spicules, without evident spongin. The primary fibres are parallel to the axis of the gorgonoid for a short distance, they then curve outwards and give off several branches, each of which terminates at the surface in a densely packed tuft of radiating spicules; if transversely arranged binding spicules are disposed; in the apical portions of the tufts they are few and far between, and obscured by numerous fragments of foreign spicules.

The primary fibres are about 0·15 to 2 mm. in diameter, and from 3 to 4 mm. apart; the secondaries at their origin measure 0·1 mm., but as they near the surface they become much wider owing to the spreading out of the spicules; the radiating tufts at the extremities are usually 0·25 or 0·3 mm. in diameter.

Megascleres:—straight cylindrical styli of the fibres and the dermal tufts, with well rounded base and obtusely pointed apex; size 0·2 to 0·22 by 0·008 to 0·01 mm.

Microscleres:—strongly bent toxa, with short straight ends which are obtuse and apparently smooth; size 0·04 to 0·05 mm. in length; these are fairly abundant in the choanosome.

* Wright and Studer—Chall. Rep., Zool., xxxi., 1889, pl. xlii., fig. 12.

Isochelæ of the Clathria type, confined to the thin dermal membrane; size 0·014.

This species is remarkable on account of the complete union of the gorgonoid with the sponge. It was only after a prolonged study of many sections that I realised its true significance. A fortunate section cut transversely displays the intimate union of the two organisms. The following is a brief description of the principal features as seen in a mounted section. The central cavity of the stem of the gorgonoid is about 1 mm. in diameter, and the wall of spicules is 0·1 mm. in thickness; laterally a bud is given off and measures 5 mm. in length and 1·2 mm. in diameter. The retractor muscles are plainly visible, together with several long vermiform mesenteric filaments. The mesenteries are also present in the main axis, and outside its walls there is no trace of the sarcode of the gorgonoid. The spicular walls are strongly contracted at the base of the tentacular crown, but again expand for a short distance and then converge to the small polyp aperture. The latter is surrounded by a layer of sponge, about 0·2 mm. in thickness. The sponge presents a series of echinating spicules which have their bases imbedded in the walls of the gorgonoid. Many are at right angles, but others are sub-parallel and finally united in a compact bundle which on approaching the surface branch several times, and ultimately form wide funnel-shaped tufts at the surface. The bases of the spicules are in close contact; at the ends of the secondary branches, their apices are widely divergent and all attain to nearly the same level. There are a few proper styli arranged transversely to the spicular tufts, but the majority of the binding spicules are of foreign origin. The space between the gorgonoid and the surface of the sponge is charged with fine brown granulose matter, and the large subdermal spaces are more or less occupied by oval bodies, which are probably the gemmules of the sponge. They consist of a series of well defined cells, and measure about 0·15 by 0·1 mm. The collar at the base of the tentacles is composed of curved spiny blunt-ended spicules about 0·25 mm. in length. The tentacles are supported by numerous fusiform spicules, which are feebly spined and measure 0·3 to 0·25 in length.

DENDORYX, *Gray*.*

DENDORYX MIRABILIS, *sp. nov.*

Station 47.

Sponge incrusting, growing on a large, branched, papyraceous worm colony. It forms around the tubes a layer of about a quarter of an inch in thickness. The surface is very porous and furnished with scattered circular oscula—about 1 mm. in

* See Part 9, p. 480.

diameter. They are situated in irregular depressions and margined by low, rounded meandering ridges. Texture firm but rather brittle; colour yellowish-grey.

Skeleton:—stellately reticulate (Bowerbank* gives a section of *Halichondria incrustans*, Johnston, which is the exact counterpart of the spicular characters of the species herein described) without obvious spongin. Mesh usually triangular and often obscured by the presence of scattered spicules. The spicular characters are rather remarkable, the choanosome is charged with stout straight or slightly curved, and strongly spined styli; the ectosome and subdermal layers present a series of slender, spined styli, and numerous straight cylindrical tornota with an abruptly tapering point ending in a slender spine; occasionally there are oval terminations, with a trace of a spine, such as are figured by Bowerbank.† The dermal surface is furnished with abundant isochelæ of two sizes, and a series of c- and s-shaped spicules; the latter are scarce, but occur more or less throughout the sponge.

Megascleres:—(1) Stout, straight or slightly curved spined styli, with the base somewhat dilated, and exhibiting numerous spines; the latter are continued on the shaft to within one diameter of the very acute apex; size 0·15 by 0·01 mm.

(2) Slender curved spine styli; size 0·1 by 0·005 mm.

(3) Tornota:—straight, cylindric, ends tapering or oval, with a terminal spine; size 0·18 by 0·006 mm.

Microscleres:—large isochelæ with the shaft almost straight; size 0·02 mm. Small isochelæ, size 0·001 mm. Sigmata simple and contort; size 0·02 mm.

This species is closely allied to *Dendoryx* (*Halichondria*) *dickiei*, Bowerbank, but the spicular characters differ greatly.

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* Bowerbank—Mon. British Spongidæ, i., 1864, pl. xxxv., fig. 323.

† Bowerbank—Mon. British Spongidæ, iii., 1874, pl. xlv., fig. 3.

Part II.

MONAXONIDA *continued.*

The present part (Part II.) embraces the remaining portion of the Monaxonida. It includes thirty species, twenty-three of which are introduced as new. Species previously described consist of some obtained by the "Challenger" Expedition and a few described by Dr. R. v. Lendenfeld. The new species have been described as fully as the material would allow and all except four have been figured. The species already described have been carefully examined and additional details added, which may be of service from a classificatory point of view.

The new species described are:—

Stylostichon conulosum.
Microciona clathrata.
Clathria striata.
„ *multipora.*
„ *chartacea.*
„ *favosa.*
„ *calopora.*
„ *arcuophora.*
Rhaphidophlus tenebratus.
„ *bispinosus.*
Echinochalina reticulata.
Allantophora plicata, gen. et. sp. nov.
Spongosorites variabilis.
Phakellia multiformis.
Axinella symbioctica.
„ *frondula.*
„ *vermiculata.*
Higginsia scabra.
Raspailia, dichotoma.
„ *echinata.*
„ *sp.*
Sigmaxinella dendroides.
„ *mammillata.*

The species of the following Sub-family previously described are :—

Plumohalichondria australis, Lendf.
Clathria lendenfeldi, R. & D.
„ *inanchorata*, R. & D.
Echinoclathria macropora, Lendf.
Echinochalina glabra, R. & D.
Phakellia jacksoniana, Dendy.
Axinella arborescens, R. & D.

Subfamily ECTYONINÆ, *Carter.*

PLUMOHALICHONDRIA, *Carter.*

PLUMOHALICHONDRIA AUSTRALIS, *Lendenfeld, sp.*

Clathria australis, Lendenfeld, Austr. Mus. Cat., xiii., Sponges, 1888, p. 222.

Clathria macropora, Lendenfeld, *loc. cit.*, p. 221.

Echinonema lævis, Lendenfeld, *loc. cit.*, p. 220.

Plumohalichondria australis, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 90.

Station 50.

Two much worn examples of this species were obtained off Shoalhaven Bight in 15-18 fathoms.

The specimens are infested with barnacles and exhibit numerous perforations made by the boring Isopod *Cymodoce*.

STYLOSTICHON, *Topsent.*

STYLOSTICHON CONULOSUM, *sp. nov.*

(Plate xlv., figs. 21, 30.)

Station 44.

Sponge incrusting, growing on the axis of a gorgonoid; it measures about 80 mm. in length, 7 mm. in its shorter and 12 mm. in its longer diameter The surface exhibits innumerable conuli, which are often compressed at the tips and bear here and there a series of minute nodules ; the latter as well as the conuli are finely hispid, with projecting spicules. The rest of the surface presents a somewhat honeycombed aspect, with a few scattered circular oscula, and small, smooth, porous, depressed, epidermal areas. Texture elastic and rather tough ; colour greyish brown.

Skeleton consisting of a series of plumose columns from 0·3 to 0·5 mm. in diameter. They give off lateral branches at irregular

intervals. These often coalesce marginally, and the mesh between the fibres varies from elongate to rhomboidal. Near the surface and in the central regions the fibres are somewhat plexoid and run parallel to each other, being separated by narrow spaces charged with scattered spicules. The fibres are composed of a central core of spined styli—about six or more spicules in a row—enclosed in a broad mass of spongin, which is densely echinated by spined styli of two sizes, the smaller being the most abundant. The larger correspond with those of the axial core in general appearance. The summits of the fibres and the valleys between are clothed with radiating tufts or irregularly scattered oxeote spicules, interspersed with an immense number of stoutish isochelæ. The latter in the choanosome are fairly scattered and about their own length or more apart, but in the ectosome they are so densely packed that it is somewhat difficult, under a low power lens, to distinguish them as separate spicules.

Megascleres :—(1) Spined styli of the spicular core and also sparsely echinating the fibres. These are slightly curved, with the base a little swollen, and very spiny ; the shaft tapers gradually to an acute point, and the spines become smaller and more distinct as the apex is approached ; size 0·15 to 0·2 by 0·01 mm. less the spines.

(2) Echinating styli, straight, spined and gradually tapering ; size 0·1 by 0·008 mm.

(3) Smooth oxea of the ectosome, straight cylindrical to within about one diameter of the not very acute points ; size 0·18 by 0·006 mm.

Microscleres :—stout, strongly curved, tridentate isochelæ ; size 0·02 to 0·024 mm.

This species is closely allied to *Stylostichon plumosa*, Montagu, but differs in habit and in its spicular characters.

MICROCIONA, *Bowerbank.*

MICROCIONA CLATHRATA, *sp. nov.*

(Plate xlvi., figs. 38-38a.)

Stations 48, 56.

Sponge arising from a small basal plate, and having a well defined peduncle, which gives off a series of more or less flattened branches ; the latter are distinct at their origin, but rapidly become lost in a mass of stoutish trabeculæ. Six out of the seven specimens are fusiform or subclavate in outline, and measure 100 mm. in height and about 40 in their greatest diameter. The

trabeculæ usually have their edges directed outwards, they vary from 1 to 3 mm. in thickness, and the spaces between are on an average about 5 mm. or less in diameter.

The surface is hispid and minutely porous; a few oscula-like openings about 0·5 mm. wide are present on some of the elevated processes.

Texture both dry and in spirits resilient and rather tough; colour from greyish-yellow to dark brown.

The skeleton consists of stout horny fibres arranged in plumose columns; they are about 0·1 mm. in diameter and the same distance apart; the lateral branches given off from the main fibres are gracefully curved and terminate at the surface in tufts of spicules.

Megascleres:—(1) Slightly curved styli or subtylostyli; the base is provided with numerous spines; the shaft also carries a series which are somewhat variable in size aud number; they are generally reflexed and are continued to within one or two diameters of the acute apex. These spicules are extremely abundant, and both echinate and invest the whole of the fibres; size 0·15 to 0·2 by 0·015 mm.

(2) Stout, curved, basally spined styli; the shaft is smooth, and gradually tapers to a long acute point. These spicules are sparingly distributed in the fibres and are here and there echinating and form slightly divergent tufts of four or five spicules at the ends of the fibres; the tufts have numerous spiny styli, enveloping the basal area and others, which are either parallel or echinating; size 0·35 to 0·45 by 0·025 to 0·03 mm.

(3) Slender, straight, smooth styli, chiefly dermal; they form radiating tufts, and also a thin layer in which the spicules are disposed at right angles to the larger projecting spicules at the ends of the fibres; size 0·15 to 0·23 by 0·0045 mm.

Microscleres:—(1) Bow-shaped toxa, rather scarce; size 0·06 to 0·1 mm. (2) Small isochelæ; size 0·009 mm.

CLATHRIA, *Schmidt.*

CLATHRIA LENDENFELDI, *Ridley and Dendy.*

Clathria lendenfeldi, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 148, pl. xxviii., fig. 5, pl. xxix., fig. 6, pl. xlvii., fig. 5.

Stations 41, 48.

There are two examples of this well-marked species in the collection. The principal specific features are the hispid surface, the lateral branches—which are usually short and are given off at nearly right angles—and the stout, very spiny, echinating spicules.

CLATHRIA INANCHORATA, *Ridley and Dendy.*

Clathria inanchorata, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 150, pl. xxviii., fig. 4, pl. xxix., figs. 13, 13a.

Station 48.

Four examples of this well marked species were obtained off Wollongong. The specimens measure about 130 mm. in height and from 5 to 10 mm. in diameter. Three out of the four examples are attached to fragments of gorgonoid stems or bits of shells. The rugose appearance of the external surface and the abundant stout toxa are characteristic of this interesting species.

The "Thetis" specimens were obtained at a depth of 56 fathoms, and the "Challenger" examples were procured from a depth of 150 fathoms.

CLATHRIA STRIATA, *sp. nov.*

(Plate xlv., fig. 27.)

Stations 36, 44.

Sponge flabellate, shortly stipitate, with a well developed attachment base. The specimen figured measures 335 mm. in height, and nearly 200 mm. in breadth; the footstalk is 10 mm. in diameter; the lamina is about 5 mm. in thickness near the base, and gradually becoming thinner as the margin and summit is approached; here it measures about 1·5 or 2 mm. The dermal surface exhibits a thin, white, porous crust, and presents a somewhat wavy aspect, together with numerous striæ about 1 or 2 mm. in diameter. The latter are very distinct on the basal half of the sponge, and their course is irregular, but mainly longitudinal; here and there they combine and form low ridges. Texture in the dried state slightly compressible, but rather brittle; colour white, the worn surface being yellowish-grey.

The skeleton consists of a stout axial plexus of horny fibres; the secondaries are given off at nearly right angles except near the summit, where they gracefully curve outwards, and terminate in radiating tufts of slender, smooth styli. The primary fibres are from 0·2 to 0·3 mm. in diameter, and are frequently less than that distance apart; they are cored with stout smooth styli, which are ill-arranged and rarely more than three or four in a row; the surface bears only a moderate number of short, faintly spined echinating styli. The spicular characters of the secondary fibres do not differ greatly from the primaries. The connecting fibres are slender, with one or more spined styli, and either with or without spicules in the axis. Centrally the mesh is oval or oblong, laterally it is more or less rectangular.

Megascleres:—(1) Short, straight, minutely spined styli; size 0·6 to 0·8 by 0·008 to 0·01 mm.

(2) Stout, straight or slightly curved smooth styli in the fibres; size 0·4 to 0·5 by 0·018 to 0·02 mm.

(3) Smooth, rarely curved cylindrical styli, the longer kind chiefly dermal; the shorter are sparingly scattered throughout the sponge; size 0·2 to 0·32 by 0·0045 to 0·006 mm.

Microscleres:—small isochelæ; these are found mostly near the surface; they occur in dense bundles or stringy fibres, and are so densely packed that it is difficult to see their form, except in the thin margins of the clusters; size 0·012 to 0·018 mm.

CLATHRIA MULTIPORA, *sp nov.*

(Plate xlv., fig. 23.)

Station 36.

Sponge arising from a well formed disc attachment, with a short peduncle and a great number of cylindric or slightly compressed branches; the mode of branching is mostly dichotomous, and anastomization is exhibited by nearly every branch. The specimen figured attains a height of 337 mm. The peduncle is about 15 mm. in diameter, and the branches vary from 5 to 10 mm. The surface generally is minutely hispid, and exhibits a white dermal incrustation, a series of shallow and mostly transverse grooves, as well as innumerable oscula in the shape of round pores, which are scattered over the whole of the branches; on an average they are about 0·5 mm. in diameter, and from 1 to 3 mm. apart.

Texture slightly resilient, but somewhat brittle; colour greyish-brown.

The skeleton consists of a series of stout primary fibres, which form a closely arranged axial column and give off at regular intervals gracefully curved secondaries which terminate at the surface in radiating tufts of spicules. The main fibres are from 0·05 to 0·1 in diameter; they have an axial core of closely arranged smooth styli, about six or more in a row. The secondary fibres measure 0·05 mm., and are usually furnished with three or four spicules in the axial line and a few distinct echinating styli. The connecting fibres are mostly unispicular and correspond with the length of the spicule. The mesh is more or less rectangular, and measures about 0·2 to 0·3 mm.

Megascleres:—(1) Straight echinating styli, with recurved spines, especially in the upper third; size 0·1 by 0·06 mm.

(2) Large smooth styli in the fibres; size 0·3 by 0·016 mm.

(3) Small dermal, smooth styli; size 0·25 by 0·0065 mm.

Microscleres :—(1) Angular chelæ ; size 0·024 mm. (2) Bow-shaped toxa ; size 0·06 mm.

Four specimens were obtained off Botany in from 20 to 23 fathoms.

CLATHRIA (?) CHARTACEA, *sp. nov.*

Stations 41, 44.

Sponge arising from a discoidal base, with a well developed compressed peduncle ; the lamina is thin, paper-like, and may consist of a flabellate frond or a number of strap-shaped expansions. The largest example obtained by the "Thetis" measures 224 mm. in height, and 60 mm. in its broadest part ; from thence it gradually narrows to the somewhat alate footstalk ; the lamina rarely exceeds about 1 mm. in thickness except near the base. A specimen from the beach at Middle Harbour consists of a short stout pedicle and three narrow fan-shaped lobes ; the measurements are as follows :—height 227 mm., total width 337 mm. The various lobes are about 60 mm. in breadth and are 4 or 5 mm. in thickness at the base, but they rapidly become thinner towards the very acute margins.

Dermal surface minutely porous, apparently smooth, but harsh to the touch, with faint indications of a white incrustation due to the radiating tufts of the stout styli of the ends of the fibres and the slender styli of the epidermis ; oscula absent (?).

Texture thin and parchment-like, resilient, and somewhat tough in spirit, but brittle when dry ; colour yellowish-grey.

The skeleton is remarkable for its stout horny fibres, which are arranged in close subparallel lines running from base to summit. The primary fibres are very evident by transmitted light in a much worn specimen ; they are subcontinuous from base to apex, and exhibit frequent dichotomous branching, with numerous slender secondaries connecting the main fibres.

The general appearance is like some textile fabric with strong longitudinally arranged threads, and connected at regular intervals by very slender processes, which are disposed at right angles to the main fibres ; the latter are from 0·25 to 0·5 mm. in diameter, and about the same distance apart. The secondaries and connecting fibres are generally about 0·1 or less in diameter and 0·4 apart. The mesh is more or less subcircular, but frequently obscured by the echinating styli, which are arranged in a sort of confused Renieroid fashion throughout the sponge.

The primary fibres are cored with a few scattered smooth styli ; the secondaries are bi- or trispicular, and at the surface the latter terminate in tufts of three or four stout styli, and are intermixed with long slender cylindrical subtylostyli with a short acute apex and a slightly spiny base.

Megascleres :— (1) Straight, fusiform, minutely spined styli; these not only echinate the fibres, but in many instances they are incorporated and arranged parallel to the large smooth styli; frequently they are enveloped in horny matter at their bases or apices forming triangular meshes, which are in keeping with the length of the spicules; size 0·1 by 0·008 to 0·01 mm.

(2) Stout, slightly curved smooth styli, with a thick well-rounded base, and gradually tapering to the acute apex; these occur in the fibres and form tufts at the surface; size 0·3 by 0·014 mm.

(3) Long straight cylindrical subtylostyli, with an abrupt acute point and a slightly spiny base; size 0·3 by 0·004 mm. This form of spicule occurs chiefly in the dermal layer, but is also found in the fibres and scattered throughout the sponge.

Microscleres :— have not been observed.

CLATHRIA FAVOSA, *sp. nov.*

Station 44.

Sponge consisting of a series of irregular subcylindrical branches; the longest is 170 mm. in length and from 3 to 7 mm. in diameter. The smaller branches exhibit a few branchlets, some of which are lateral and others dichotomous, but without any coalescence. Surface minutely honeycombed; the cells are from 1 to 2 mm. in diameter, and often covered by a white porous membrane; the walls are thin, prominent, and finely hispid.

Texture rather inelastic and somewhat brittle; colour, when the dermal surface is intact, white, elsewhere yellowish-grey.

Skeleton :—the primary fibres consist of densely packed styli, enclosed in a thin sheath of spongin; they are about 0·1 mm. more or less in diameter; the secondaries have usually three or four spicules in a row, and the connecting fibres are 0·5 in diameter and frequently aspiculous; both the smooth and spined styli are often limited to one or two. The mesh is reticulate but very loose and irregular, varying from oblong to rhomboidal, and from 0·4 to 0·5 mm. in diameter.

Megascleres :—(1) Short, stout, spined, echinating styli, very few in number and widely scattered or absent altogether in some parts of the skeleton; near the ends of the fibres they are, however, more frequent, and often occur in tufts of three or more; they are cylindrical to within about two diameters of the abruptly pointed, conical apex. The base has three or four irregular spines; the middle third of the shaft is smooth, and the distal—less the acute conical point—bears a few long stoutish spines, some of which almost equal half the diameter of the spicule; size 0·6 to 0·7 by 0·01 mm.

(2) Straight smooth styli, chiefly dermal, but also scattered in the choanosome ; size 0·13 to 0·2 by 0·008 mm.

(3) Large smooth styli, of the main fibres, generally more or less curved, and gradually tapering to long acuminate points ; size 0·3 by 0·01 to 0·015 mm.

Microscleres :—(1) Slender toxodragmata, rather abundant ; size 0·07 to 0·12 by 0·002 mm.

(2) Strongly bent toxa, scarce ; size 0·035 by 0·0015 to 0·002 mm.

(3) Isochelæ with a nearly straight shaft and long flukes which almost meet at the ends ; size 0·018 mm.

(4) Very small isochelæ ; size 0·008 to 0·01 mm.

The above species is closely allied to *Clathria typica*, Carter, sp., but on comparison with many examples from Victoria it appears to be quite distinct ; the spicular characters enumerated above separate it from any other species known to or examined by the writer.

CLATHRIA CALOPORA, *sp. nov.*

(Plate xlvi., fig. 34.)

Station 50.

Sponge consisting of a series of knotty cylindrical branches ; the branching is either dichotomous or lateral, and coalescence is evident in some parts. The specimen is 195 mm. in height, and the branches vary from 3 to 8 mm. in diameter. Surface hispid, reticulate, finely porous throughout ; the pores are mostly circular and about 1 mm. or less in diameter ; the walls are thin, prominent, and minutely conulose, presenting a minutely honeycomb-like surface without any distinct trace of dermal incrustation.

Texture hard, inelastic, and rather tough ; colour greyish-yellow.

Skeleton consisting of stoutish horny fibres, which are densely clothed with short but very spiny echinating spicules ; the axial core is slender, and has from 3 to 6 spicules in a row, the apices of which are more or less divergent. Near the surface a number of slender styli occur, some of which run parallel to the stout styli of the core, and at the surface they are either arranged at right angles or form a thin layer and occasional radiating tufts. Long slender sinuous toxa subtend the fibres, especially in the curves of the mesh ; some few exhibit a very slight well rounded bend in the middle, but the majority are arranged in wavy bunches.

The primary fibres are sinuous and often plexoid, in some places they almost form a complete horny core ; they are usually from 0·2 to 0·4 or more in diameter ; the secondaries are given off at an acute angle, and after traversing the axial line for a

short distance, branch off at right angles and form the walls of the pores at the surface; the connecting fibres are few and far between, and are usually about 0·5 to 1 mm. in diameter.

The mesh between the main fibres is usually elongate, and about 0·3 mm. in diameter; laterally and near the surface it becomes round or rectangular; all the fibres, especially the apices, are very densely covered with echinating styli, the bases of which are in close contact, and scarcely admit of additional spicules.

Megascleres:—(1) Short, stout, entirely and strongly spined styli; these echinate the fibres in vast numbers; size 0·3 to 0·8 by 0·012 mm.

(2) Stout, curved, smooth, acutely pointed styli; these occur in the fibres and form radiating tufts at the surface; size 0·3 to 0·5 by 0·0015 to 0·022 mm.

(3) Curved or straight slender styli, with a tendency to become subtylostyli; chiefly dermal, but also scattered between the fibres; size 0·15 to 0·2 by 0·002 to 0·004 mm.

Microscleres:—(1) Long slender toxa mostly in bundles; scattered ones have usually a long bend in the centre; size 0·2 to 0·3 by 0·002 mm.

(2) Isochelæ of the usual Clathria type; size 0·008 to 0·01 mm.

CLATHRIA ARCUOPHORA, *sp. nov.*

(Plate xlv., fig. 29.)

Station 8.

Sponge with a discoidal base, short peduncle, and an irregular flabellate lamina; the latter is 225 mm. in height and 170 mm. in breadth, and from 3 to 5 mm. in thickness; the pedicel is 70 mm. long and 15 mm. in diameter. Surface faintly marked with longitudinal ridges; the lamina when viewed by transmitted light appears as if it consisted of a series of coalescent branches, between which many thin places and some perforations occur. The dermal layer is thinly coated with a delicate membrane, which is moderately charged with radiating tufts of smooth stylote spicules; these occur between the stout projecting styli at the ends of the fibres. The oscula are regularly distributed over the whole of the sponge; they are from 0·5 to 1 mm. in diameter, and about 1 or 2 mm. apart; the intermediate spaces are finely reticulate and minutely porous.

Texture inelastic, brittle, and extremely harsh to the touch, the latter character being due to the numerous projecting spicules; colour greyish-yellow.

The skeleton consists of a series of stout primary fibres ; they are longitudinally arranged, and present a very wavy outline ; they exhibit a few scattered, echinating, spined styli, and an axial core of from two to six or more stout smooth styli ; they are usually about 0·15 mm. in diameter and 0·35 mm. apart ; the secondaries are about 0·1 mm. or less in diameter, and the spicular core appears to be increased in size as the surface is approached ; each fibre terminates in a divergent tuft of from six to twelve acutely pointed styli ; the connecting fibres are mostly uni- or bispicular, with only a trace of spongin ; the length of the spicule evidently regulates the distance between the stouter fibres ; frequently a solitary spicule may be seen ensheathed in a scarcely perceptible layer of spongin, and yet it exhibits from one to three or four echinating styli.

The mesh is rather variable and may be round, oval, or sub-rectangular ; this is due to the spreading of the spongin at the points of origin or union of the fibres ; the average diameter is about 0·3 to 35 mm.

Megascleres :—(1) Echinating spined styli, which are very irregularly distributed and usually are about half their length apart on the more slender fibres, but on the primaries they are widely separated. The base is slightly swollen ; the shaft is faintly spined and rapidly tapers from the middle to a long, smooth, acute point ; size 0·35 by 0·008 mm.

(2) Slightly curved, stout, smooth styli, with a well rounded base and a long acutely pointed apex ; these are chiefly confined to the fibres ; size 0·3 to 0·4 by 0·022 to 0·024 mm.

(3) Slender, smooth, cylindrical styli ; abundant in the dermal layer as radiating tufts, and also scattered between the fibres ; the base is often perceptibly enlarged and is generally tipped with a series of minute spines ; the apex terminates in an abrupt acute point ; size 0·2 to 0·3 by 0·0045 to 0·005 mm.

Microscleres :—(1) Small toxa 0·04 by 0·0025 mm. (2) Large, stout, bow-shaped toxa, size 0·11 by 0·04 mm., both forms are abundant everywhere, except in the epidermal region and the axis of the fibres. (3) Small isochelæ fairly plentiful throughout the sponge ; size 0·02 mm. This form approaches *Clathria angulifera*, Dendy, in some of its characters, but the habit and the size of the spicules differ greatly.

RHAPHIDOPHLUS, *Ehlers.*

RHAPHIDOPHLUS TENEBRATUS, *sp. nov.*

(Plate xlv., fig. 19.)

Station 48.

Sponge with a slightly expand base, and a short peduncle, from which arise a series of parallel branches ; they are more or

less coalescent and connected by transverse branchlets, thus forming a subflabellate clathrous expansion. The branches are flattened in the plane of branching, and measure from 5 to 15 mm. in their greater and 3 to 4 mm. in their lesser diameter; the total height is 200 mm., and the greatest width about 60 mm.; the peduncle is 40 mm. long and 5 mm. thick. The surface generally is very rugose and marked by a series of sinuous grooves and uneven knotty ridges; near the summit of the sponge the grooves and ridges become more regular and distinct. The dermal layer of spicules is rather scanty and partly obscured by the large smooth styli which project from the ends of the fibres in great numbers and give the stem and branches an extremely hispid appearance. The branches exhibit abundant perforations; these are situated in the grooves; they are from 1 to 2 mm. in diameter and 2 or 3 mm. apart. By transmitted light the sponge appears as if it had been riddled by small shot. These perforations probably represent the oscula; the ridges are reticulated and minutely porous.

Texture slightly compressible, but very tough; colour greyish-brown.

The skeleton consists of a series of very stout, horny fibres; in the axial region they are from 0·4 to 0·5 mm. in diameter; occasionally some appear to have coalesced and measure from 0·7 mm. In the less dense portions of the axial plexus the primaries are usually 2 or 3 mm. in diameter; the secondaries are about the same, but diminish to 1·5 or 1 mm. near the surface; the connecting fibres are 1 mm. or less. The spicular core consists of stout, smooth styli, with from 3 to 5 in ill-arranged rows; they are approximated at the base and more divergent at their apices, especially at the terminal portions of the fibres.

The echinating styli are unevenly distributed, being abundant only on the secondaries, or the outer part of the primaries, where they form the encircling margin of the larger pores. The mesh centrally is oblong and about twice as long as broad; elsewhere it is more or less subquadrangular.

Megascleres:—(1) Straight, gradually tapering, and entirely spined styli; size 0·08 to 0·1 by 0·008 mm.

(2) Stout, curved, smooth styli; size 0·25 to 0·5 by 0·015-0·018; the latter occur in the fibres and project more than half their length at their ends.

(3) Straight, slender styli; these form the dermal crust and are also scattered throughout the sponge; the base is often a little swollen and tipped with a few minute spines; the apex is long and acute; size 0·25 to 0·4 by 0·005 mm.

Microscleres:—(1) Long, slender toxa, with a very slight bend in the middle and straight shafts; size 0·2 mm.; they occur throughout the choanosome and often arranged in bundles.

(2) Small isochelæ rather abundant especially in the dermal region ; size 0·016 mm.

The species described above is closely allied to *R. filifer*, Ridley and Dendy, but differs in wanting the thick dermal crust, as well as in habit and a slight difference in the spicular characters. It also differs from *R. seriatus*, Theile, in habit and in the size of the spicules. *R. topsenti*, Theile, is allied in general features as to surface and mode of branching, but here again the spicules differ in size, and in *R. topsenti* the peculiar toxa are absent (?).

RHAPHIDOPHLUS BISPINOSUS, *sp. nov.*

Station 45.

Sponge arising from a well defined discoidal base, with a short peduncle, and two primary and four short secondary branches. The total height is 50 mm., and the diameter of the somewhat angular stem and branches is from 4 to 5 mm. The surface is minutely honeycombed and densely hispid, with projecting, smooth, stylote spicules. The dermal membrane is finely porous and here and there forms a tympanic covering over the apices of the cells. Oscula apparently absent. Texture highly elastic, reticulate, and rather tough ; colour yellowish-grey.

The skeleton consists of an open network of fibres with a moderate amount of spongin ; the primaries are cored with stout and also with slender smooth styli, intermixed with which are a number of spined styli ; these are fairly uniform in length, but vary greatly in diameter. The spicules in the primary fibres are arranged in compact bundles, about 0·2 mm. in diameter ; in the secondaries they are more diffused and generally divergent at their apices ; the connecting fibres consist of one or two rows of spicules, but as a rule they are ill defined, and the mesh is occupied with scattered spicules. All the fibres are echinated by spined styli, and also by long smooth styli ; the latter are arranged at right angles and are fairly abundant centrally ; at the ends of the fibres they are densely packed and project through the dermis, thus giving the surface its hispid appearance. The mesh is usually elongate and about 0·25 to 0·5 mm. in its narrow diameter.

Megascleres :—(1) Curved, gradually tapering, and wholly spined styli ; the base is somewhat swollen, the apex acute, and the longer spines are recurved ; these chiefly echinate the fibres ; size 0·17 to 0·2 by 0·01 mm.

(2) Slender, straight, spined styli ; these occur in the fibres and scattered in the choanosome ; size 0·2 by 0·002 mm. or less.

(3) Long curved styli; the base is spiny for about one or two diameters; the shaft is smooth and terminates in a very acute point. This form of spicule forms the main part of the axial core and also echinates the fibres, as well as projecting through the dermal surface for half or two-thirds their length; size 0·7 to 1 mm. by 0·015 mm.

(4) Slender, straight, cylindrical, smooth styli of the fibres, choanosome, and dermal membrane; size 0·25 to 0·5 by 0·003 to 0·004 mm.

Microscleres:—isochelæ, these are fairly plentiful in all parts of the sponge; size 0·02 mm.

ECHINOCLATHRIA, *Carter.*

ECHINOCLATHRIA MACROPORA, *Lendenfeld, sp.*

Plectispa macropora, Lendenfeld, Austr. Mus. Cat. xiii., Sponges, 1888, p. 226.

Echinoclathria macropora, Whitelegge, Rec. Austr. Mus., iv., 2 and 5, 1901-2, pp. 35, 117, 212.

Stations 37, 44, 48, 50.

Four examples of this species are in the collection; the largest is about 500 mm. in height and over 100 mm. wide. The sponge consists of a tangled mass of anastomozing branches from 5 to 15 mm. in diameter. After full examination I feel inclined to regard this form as being quite distinct from *Echinoclathria carteri*, Ridley and Dendy.

AULENA, *Lendenfeld.*

AULENA GIGANTEA, var. MICROPORA, *Lendenfeld, sp.*

Halme gigantea, Lendenfeld, Proc. Linn. Soc. N. S. Wales, x., 1886, p. 849.

Aulena gigantea, var. *micropora*, Lendenfeld, Austr. Mus. Cat. xiii., Sponges, 1888, p. 230.

Aulena gigantea, var. *micropora*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 118.

Stations 8, 54.

Several specimens of this variety are in the collection from Barranjoey and Jervis Bay. The examples do not, however, afford any additional characters to those already published.

ALLANTOPHORA, *gen. nov.*

Sponge branched; skeleton reticulate; fibres with a moderate amount of spongin, cored and echinated by smooth monactinal megascleres. Microscleres:—sigmata, microxea, and microstrongyla.

ALLANTOPHORA PLICATA, *sp. nov.*

(Plate xlv., fig. 28.)

Station 53.

Sponge composed of an intricate mass of flattened branches; their edges are directed outwards; they are acute, and finally terminate in long acuminate points. Centrally the various lamellate branches are here and there coalescent, from base to summit, so that a transverse section would present an irregular honeycombed structure with wide cells. The specimen is 130 mm. in height, 90 mm. in its greater and 60 in its lesser diameter. The branches vary from 3 to 10 mm. in thickness and from 10 to 30 mm. in width. The surface generally presents a series of highly conulose, longitudinally disposed ridges, between which numerous pores are situated; they vary from round to oval or elongate, and are from 3 to 5 mm. in diameter. The pores are enclosed by thin fibrous walls, which are fringed with slender conulose processes about 5 mm. long and 2 or 3 mm. apart. The sponge is somewhat water worn, and the dermal layer is only visible here and there as a thin transparent membrane covering some of the pores; this epidermal film is richly furnished with microscleres, including sigmata, microstrongyla, and microxea. Texture hard, inelastic, tough, and presenting a coarse, fibrous surface; colour greyish-yellow.

Skeleton centrally reticulate, with oblong or elongate mesh; apically or laterally there is a tendency to become plumose. The primary fibres consist of a moderate amount of pale spongin, cored with dense whispy bundles of smooth styli; their diameter varies from 0·2 to 0·4 mm., and they are usually about 0·5 to 0·6 mm. apart. The secondaries are similar to the primaries, but slightly thinner; the connecting fibres are few and far between except in the central region, where they measure from 0·05 to 0·1 mm., and are cored with six or more spicules in a row. All the fibres are abundantly echinated by smooth styli, which are usually disposed at right angles, but occasionally they occur in subradiating tufts consisting of several spicules.

Megascleres :—(1) Smooth echinating styli, often slightly bent near the base ; size 0·25 to 0·4 by 0·014 to 0·016 mm. (2) Smooth straight styli of the core ; size 0·45 to 0·5 by 0·008 to 0·012 mm.

Microscleres :—(1) Sigmata, extremely abundant throughout the sponge especially in the dermis ; size 0·018 mm. (2) Microxea, scattered or in loose bundles ; size 0·08 to 0·1 by 0·0015 to 0·002 mm. (3) Microstrongyla ; these are present in great numbers everywhere ; size 0·01 to 0·02 by 0·006 to 0·008 mm.

The genus is evidently intermediate between *Echinoclathria* and *Ophlitaspongia*.

ECHINOCHALINA, *Thiele*.

ECHINOCHALINA RETICULATA, *sp. nov.*

(Plate xlv., figs. 25-25a.)

Stations 48, 53.

Sponge consisting of a rather loose, irregular, honeycombed network of thin trabeculæ ; the latter are connected—in the dried skeleton—by delicate webs of interlaced fibres which form the walls of the cells. In spirit examples the gossamer-like partitions are covered with a very thin layer of sarcode ; the epidermal surface exhibits a series of small pores, with here and there a few circular areas covered by a tympanic membrane. There is no trace of oscula, except the pores are to be regarded as such. Texture resilient, and rather tough ; colour grey.

The skeleton consists of a series of horny fibres, which are often trellis-like in arrangement, but near the surface they are somewhat plumose ; the primaries measure from 0·1 to 0·2 mm. in diameter, and are densely echinated by smooth, straight, tapering styli, and exhibit a slender core of ill-arranged slender tylostyli and tylota. The secondary fibres are about 0·5 mm. or less in diameter, and internally they either have two or three distinct spicules or are aspiculous. The connecting fibres are very slender and form an intricate network between the primaries and secondaries ; they usually present from three to four echinating styli on one side and occasionally one or more slender spicules within. The mesh is generally narrowly oval or oblong and about 0·2 mm. wide.

Megascleres :—(1) Straight, smooth styli, echinating the fibres ; size 0·15 by 0·008 to 0·01 mm. (2) Slender, straight tylostyli, in the fibres ; size 0·22 by 0·004 mm. (3) Straight, slender tylota, with evenly rounded ends ; size 0·22 by 0·0045 mm. The latter occur chiefly in the dermal membrane.

ECHINOCHALINA GLABRA, *Ridley and Dendy, sp.*

Echinoclathria glabra, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 163, pl. xxix., figs. 11, 11a, pl. xxxi., fig. 2.

Station 48.

Five examples of this species were obtained off Wollongong. They are mostly washed out specimens but they afford sufficient characters to recognise their full specific value as described in the "Challenger" Report. All the specimens are attached to dead gorgonoid stems or to large branching colonies of bryozoa, and agree with the figured type in contour less the fleshy connecting ridges, which are somewhat broken and only here and there exhibit a continuous surface.

The skeleton agrees with the published description. The spicules, however, are slightly larger than those of the type, a fragment of which was presented as a mounted slide by Prof. Dendy from the "Challenger" specimen (R.N. 707, Dendy). The latter example affords the following spicular measurements: echinating smooth subtylostyli 0·11 by 0·0063 mm.; long smooth tylota 0·22 by 0·0032 mm. The spicules of the "Thetis" specimen are as follows: echinating smooth styli 0·12 to 0·16 by 0·007 to 0·008 mm.; tylota 0·2 to 0·23 by 0·0045 mm.

Family AXINELLIDÆ, *Ridley and Dendy.*

PHAKELLIA, *Bowerbank.*

PHAKELLIA JACKSONIANA, *Dendy.*

Phakellia jacksoniana, Dendy, Proc. Roy. Soc. Vict., ix., n.s., 1897, p. 236.

Phakellia flabellata, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 171, pl. xxxiv., figs. 2, 3, 3a, pl. xl., figs. 6, 6a.

Station 44.

Six examples of this well marked species were obtained off Coogee in 49 to 50 fathoms. The specimens display considerable variation; they are flabellate, with here and there an elongated opening in the frond; the rest are branched at the base, and many are either slightly coalescent or free at their dilated apices. Apart from the slight difference in habit the examples agree in every detail as to surface, structure, and spicular characters with the "Challenger" description and figures.

PHAKELLIA MULTIFORMIS, *sp. nov.*

(Plate xlvi., fig. 41.)

Station 44, 46, 47, 48, 50.

Sponge varying from spatulate to flabellate or half to complete cup-shape; in the latter form the cup is always higher than broad. The figured example is 200 mm. high, 120 mm. in diameter and from 3 to 5 mm. in thickness. All the specimens (about 20) have a more or less distinct peduncle, which is usually about 10 mm. or more in diameter, and from 10 to 40 mm. in length.

The surface is harsh to the touch, and abundantly supplied with small pores about 0·3 mm. in diameter and from 0·2 to 0·4 apart. Both inner and outer surfaces are alike and destitute of oscula. The marginal area is thin, and presents a series of minute ridges; these are 0·3 in diameter, about 0·25 apart, and extending on each surface for a distance of 3 or 4 mm.

Texture hard, tough, and somewhat elastic; colour yellowish-white.

Skeleton composed of a series of stoutish bundles of spicules from 0·3 to 0·4 mm. in diameter; they exhibit little or no spongin. The primary fibres are rather indefinite, but the secondaries are well defined. They are about 0·1 or 0·15 mm. in diameter and 0·2 to 0·25 mm. apart. They are given off mostly at right angles and terminate at the surface in tufts of radiating spicules.

Megascleres:—(1) Curved or slightly bent styli; size 0·2 to 0·25 by 0·02 mm. (2) Curved oxea, tapering at the ends to not very acute points; size 0·15 to 0·25 by 0·018 to 0·02 mm. This species is allied to *Phakellia villosa*, Carter, and *Phakellia crassa*, Carter, but it differs from both in its spicular characters.

AXINELLA, *Schmidt.*

AXINELLA SYMBIOTICA, *sp. nov.*

(Plate xlvi., fig. 33.)

Stations 34, 53.

Sponge more or less flabellate, with a series of irregular terminal branches, some of which are coalescent at a short distance from their origin. The example figured measures 180 mm. in height and about the same in breadth. The branches vary from 5 to 20 mm. in width and are usually 5 mm. in thickness. The surface is generally beautifully reticulate, having here and there a few smooth patches, due to a grey incrustation. The rest of

the surface exhibits numerous verruciform processes; the latter are from 2 to 3 mm. apart and from 0·5 to 1 mm. in height; on the marginal areas of the branches they are a little more prominent. Texture rather brittle, harsh to the touch, and slightly compressible; colour yellowish-grey.

Skeleton composed of a few very stout, axial, primary fibres, from 0·5 to 0·8 mm. in diameter. The secondaries are given off at pretty regular intervals; they are about 0·25 mm. in diameter at their origin, but as they approach the surface in graceful curves they rapidly diminish in diameter and finally terminate in tufts of radiating spicules, of about twelve or more. The fibres consist of a large amount of dark yellow spongin; they frequently anastomose, and although the plumose ramification is well marked at the surface, the central regions present a more or less reticulate appearance.

Megascleres:—(1) Slightly curved styli, gradually tapering to acute points; size 0·2 to 0·25 by 0·01 to 0·015 mm. (2) Curved, blunt-ended styli and strongyli, the latter rather abundant; size 0·25 to 0·3 by 0·015 to 0·02 mm. (3) Oxea bent in the middle; very scarce and may not belong to the sponge.

In my preliminary examination of this species it was noted as a commensal with a gorgonoid. In the final examination I failed to find the latter to fix it definitely. Still the specimen contains abundant spicules in the verrucæ, and when boiled out in caustic soda they were to be seen in great numbers. The spicules remind one of irregular bundles of *Nostoc*, being arranged in bead-like lines, and in many cases they are dumbbell-shaped, but perfectly smooth. Spicules of gorgonoid:—size 0·015 by 0·004 mm.

AXINELLA ARBORESCENS, *Ridley and Dendy.*

Axinella arborescens, Ridley and Dendy, Chall. Rep., Zool., xx., 1887, p. 1, 178, pl. xxxv., fig. 4-4a.

Stations 34, 44, 53.

Three examples of this species are in the collection; they agree in every character with the description in the "Challenger" Report.

AXINELLA FRONDULA, *sp. nov.*

(Plate xlvi., fig. 32.)

Station 50.

Sponge consisting of a thin frondose lamina, 75 mm. high, 50 mm. in width, and from 1 to 2 mm. in thickness. There is a distinct flattened peduncle which gives rise to four well marked lobes; these are more or less dilated apically and either rounded or truncated.

Surface partly covered with a thin transparent membrane beneath which may be traced a series of subradiating grooves about 0·5 to 1 mm. in diameter. The abraded surface is finely pilose, and velvet like to the touch. Texture soft, flexible, elastic, and tough; colour generally olive brown, but inclined to grey where the epidermis is intact.

Skeleton consisting of rather slender, but numerous whispy bundles of more or less plumosely arranged spicules, which terminate in divergent tufts at the surface.

Megascleres:—(1) Straight or but little curved styli with a well rounded base and an acute apex; size 0·4 to 0·45 by 0·008 to 0·012 mm.

(2) Short styli frequently with a slight bend near the base; size 0·15 by 0·004 to 0·005 mm.

(3) Slightly curved oxea; size 0·11 by 0·0035 mm. The oxea are very scarce and occur chiefly in or near the dermal portion of the sponge.

AXINELLA VERMICULATA, *sp. nov.*

(Plate xlvi., fig. 43.)

Station 53.

Sponge stipitate, flabellate, but equally expanded; the marginal border is rather thin and exhibits a series of irregular lobes, separated by incisions of varying width and depth.

Surface generally minutely conulose, neatly reticulate, and finely porous. The most striking features, however, are the numerous subradiating ridges and grooves; the latter are usually from 2 to 3 mm. wide, and the former vary between 1 to 3 mm. in height and in thickness. The grooves commence in the central areas of both surfaces, and after a more or less sinuous course converge, and become deeper and more distinct between the lobes at the margin of the frond. There is no definite trace of oscula, except a few scattered apertures or perforations be regarded as such.

Texture hard, incompressible, and tough; colour greyish-yellow.

Skeleton:—The central regions of the sponge consist of a series of plexoid fibres, which are scarcely distinguishable on account of the large amount of spongin and the numerous scattered spicules; the secondary fibres are, however, very distinct; they are usually about 0·25 mm. in diameter and from 0·3 to 0·5 mm. apart. There is an axial core of closely arranged spicules; this is echinated with numerous others, which are disposed at an high angle and terminate in radiating tufts at the surface. Between the latter a few scattered oxea occur and are generally disposed at right angles to the fibres.

Megascleres :—(1) Short, straight styli, chiefly axial and scattered in the choanosome ; size 0·3 to 0·4 by 0·025 mm. (2) Styli both marginal and terminal ; size 0·6 to 0·65 by 0·02 to 0·025 mm. (3) Curved oxea ; size 0·35 to 0·45 by 0·01 to 0·015 mm.

HIGGINSIA, *Higgins.*

HIGGINSIA SCABRA, *sp. nov.*

(Plate xlvi., fig. 44.)

Station 34.

Sponge sub-flabellate, with a few flattened branches, some of which are coalescent. The figured specimen is 110 mm. in height and about the same in width ; the branches are from 8 to 12 mm. in thickness. Surface uneven and closely conulose, the conuli being about 3 to 5 mm. high, and from 1 to 3 mm. apart. The epidermal membrane is neatly arranged between the conuli, forming a smooth coating with here and there a few circular pores. Oscula, either apical, marginal, or occasionally on the flat surface of the sponge ; their diameter varies from 2 to 5 mm.

Texture hard, incompressible, and somewhat brittle ; colour yellowish-cream.

Skeleton :—The primary fibres are somewhat indefinite and obscured by a confused envelope of spicules ; in some places, however, an axial series may be distinguished consisting of from six to twelve closely arranged spicules ; in longitudinal section the fibres present features which may be described as nodes and internodes ; the latter affords a view of the spicules indicating the course of the fibres, and the former exhibit dense nodes of spicules, from which the secondary fibres arise ; from their origin their course is upwards and outwards ; in each fibre a distinct axial thread of three or more spicules can be traced ; they are frequently hidden from view by numerous sub-echinating spicules which terminate in radiating tufts at the surface, being most evident on the apices and sides of the conuli.

Megascleres :—oxea of two sizes—(1) generally curved and tapering to acute points about three or four diameters from the extremities ; size 0·7 by 0·024 mm.

(2) Slender, curved, and gradually tapering to acute points ; size 0·6 by 0·01 mm.

Microscleres :—microxea somewhat boomerang-shaped, with a sharp bend in the middle ; they are minutely spined throughout their length, and are very abundant in the epidermal membrane and scattered in the intrafibrous portions of the sponge.

This species is described with some hesitation, but the spicular characters differ considerably from those hitherto known, both in arrangement and in dimensions of the spicules.

SIGMAXINELLA, *Dendy.*

SIGMAXINELLA MAMMILLATA, *sp. nov.*

(Plate xlvi., fig. 39.)

Station 15.

Sponge consisting of about ten mammiform processes, arising from a well developed base and a short peduncle; the branches are coalescent in their lower three-fourths, but mostly free at the summits. The example is 70 mm. high, 75 mm. wide, and about 40 mm. in thickness. The free apices of the branches vary from 15 to 25 in height and are generally 15 mm. in diameter. The surface has a thin epidermal layer provided with numerous minute pores about 0·5 mm. or less in diameter; these are more or less connected by a series of small radiating grooves; the pores are from 1 to 1·5 apart and are evenly distributed over the whole sponge. In places where the dermis has been abraded the surface presents a velvet-like aspect. The summits of the well-rounded or sometimes slightly compressed branches bear from two to seven oscula from 1 to 1·5 or 2 mm. in diameter; interspersed between the oscula apertures are a series of subradiating grooves 0·5 wide, and extending down the sides for a distance of 5 mm. or more.

Texture rather hard, tough, and resilient; colour yellowish-brown.

Skeleton composed of a series of somewhat diffuse primary and secondary fibres; the former are from 0·3 to 0·5 mm. in diameter, and consist of ill-arranged spicules imbedded in much yellow spongin; the latter are better defined; they are about 0·1 to 0·15 mm. in diameter, and the spicules are arranged in axial lines of six or more, with a series of echinating spicules placed at rather acute angles, and finally terminating in radiating tufts at the surface. The secondary fibres are mostly given off at right angles to primaries, and here and there connecting fibres are present containing one or two spicules. The length of the latter indicates the distance between the fibres.

Megascleres:—styli with a straight shaft tapering to an acute point; the base is usually bent about two or three diameters from its well-rounded extremity; size 0·25 to 0·28 by 0·015 to 0·018 mm.

Microscleres:—sigmata, 0·03 by 0·0025 mm.

SIGMAXINELLA DENDROIDES, *sp. nov.*

(Plate xlvi., fig. 42.)

Station 41.

Sponge arising from a peduncle 25 mm. long and 5 mm. in diameter. The branches are dichotomous, subparallel, frequently coalescent, and terminate in acute points. The figured specimen is 180 mm. high and about 70 wide. The branches are usually from 4 to 5 mm. in diameter. The surface has been denuded of its epidermis and presents an extremely villose appearance, from the base to the summits of the branches.

Texture tough, resilient, and compressible; colour yellowish-grey.

Skeleton composed of a series of very slender primary fibres about 0·7 mm. in diameter; these are centrally situated and consist of five or six spicules. The secondaries are composed of two or three closely arranged spicules with only a trace of hyaline spongin; they are gracefully curved upwards and outwards and terminate at the surface in tufts of spicules, which are mostly subparallel, but rarely radiating.

Megascleres:—straight or but little curved styli; their greatest diameter is near the centre; the base is rounded and apex tapers to a not very acute point; size 0·45 to 0·5 by 0·01 to 0·02 mm.

Microscleres:—sigmata 0·025 by 0·002 mm.

This species is apparently intermediate between *Sigmaxinella australiana*, Dendy, and *S. arborea*, Kirkpatrick.

SPONGOSORITES, *Dendy.*

SPONGOSORITES VARIABILIS, *sp.*

(Plate xlvi., fig. 45.)

Station 53.

Sponge rudely cup-shaped, with several lateral lamellæ both within and without. The specimen has a short peduncle, but the base is wanting; when obtained it was probably torn from its support, and the cup-like shape was also destroyed; the example figured is only half of the original. When complete the measurements would be approximately as follows:—130 mm. high, 120 mm. in its greater and 80 mm. in its lesser diameter; the walls of this cup and the lamellæ vary from 7 to 2 mm. in thickness. The marginal region of the sponge is irregularly lobate and somewhat coarsely fimbriate.

The outer surface presents a series of low longitudinal ridges which are more or less radiate and terminate at the ends of the lobes; the inner aspect exhibits numerous shallow radiating grooves, which are furnished with abundant oscula (?) pores from 0·5 to 1 mm. or more in diameter; when viewed by transmitted light the sponge appears as if it had been perforated with very small shot. The dermis is somewhat silvery white, minutely porous, and fairly smooth. Texture elastic and rather tough; colour yellowish-grey or cream.

Skeleton plumose consisting of loosely arranged whispy-bundles of spicules; the fibres when distinct are generally about 0·5 mm. in diameter, the same distance apart, and enclosed in a considerable amount of pale diffused spongin. The dermal layer is about 0·1 in thickness, and is charged with numerous small oxea.

Megascleres:—styli of various shapes and sizes.

(1) Tapering, acutely pointed styli, with a sharp bend near the base, or curved in the basal third; size 0·6 to 0·15 by 0·02 to 0·03 mm.; these are very plentiful.

(2) Straight, acutely pointed styli; size 0·5 by 0·02 to 0·03 mm.

(3) Long, cylindrical, sharp point styli; size 1·3 to 1·5 by 0·02 mm.

Microscleres:—small, straight oxea; size 0·08 to 0·004 mm. Besides the above no other oxea have been observed.

RASPAILIA, *Nardo.*

RASPAILIA ECHINATA, *sp. nov.*

(Plate xlvi., fig. 37.)

Stations 44-47.

Sponge pedunculate, with a small attachment disc, a well-defined pedicel, and numerous dichotomous branches which are cylindrical and disposed in a plane. The apices of the branches are neatly rounded except in two cases—indicating further dichotomization—in which they are broad and compressed; their diameter is about 5 to 7 mm. Surface minutely honeycombed; the cells are generally oblong, and their marginal walls are furnished with numerous rigid, sharp, aculeations from 1 to 1·5 mm. in height and about 0·5 to 1 mm. in diameter. Texture hard, elastic, and extremely harsh to the touch; colour dark greyish-brown.

Skeleton consisting of a series of slender subparallel fibres without much evident spongin; their course is axial, and at the surface they bifurcate and terminate in closely arranged tufts of long, stout styli. The primary fibres are about 1·5 mm. in dia-

meter, and contain about 6 or 8 spicules in a row ; the secondaries are scarce and ill-defined except near the surface ; they are generally bi- or trispicular and measure 0·5 mm. The connecting fibres are mostly unispicular and occur at fairly regular intervals, being arranged at right angles ; the mesh is square or oblong, and is usually about 0·3 by 0·4 mm. in diameter.

Megascleres :—(1) Straight, smooth styli of the fibres and dermis ; size 0·9 to 1·05 by 0·02 to 0·025 mm.

(2) Slightly curved, smooth styli of the connecting fibres ; size 0·3 to 0·5 by 0·01 mm.

(3) Short, straight, echinating styli ; the shaft, base, and the abruptly-pointed apex are more or less covered with recurved spines ; size 0·5 to 0·6 by 0·02 mm.

RASPAILIA DICHOTOMA, *sp. nov.*

(Plate xlvi., fig. 36.)

Station 44.

Sponge with a small discoidal base, a short peduncle, and numerous curved, subcylindrical, dichotomous branches, chiefly disposed in a plane. The figured specimen is 200 mm. high and about 70 mm. wide ; the branches and peduncle vary from 3 to 5 mm. in diameter ; the apices are more or less acutely pointed. Surface reticulated, with irregular honeycombed or villose patches here and there, which are frequently interrupted by shallow, longitudinal grooves, the latter presenting a few small pores. Oscula scattered, about 1 mm. or less in diameter.

Texture hard, incompressible, and somewhat brittle ; colour greyish-yellow.

Skeleton composed of a dense series of slender primary fibres about 0·15 mm. in diameter and 0·2 mm. apart ; scattered spicules are present in such numbers that the main fibres cannot be traced in the central regions of the branches ; the secondaries are more definite, especially near the margins ; they are 0·05 mm. in diameter and a little more apart at the surface ; they terminate in long, whispy tufts of slender styli ; these are crossed and inlaced by short, curved oxea.

Megascleres :—(1) Straight, smooth styli, variable in dimensions ; size 0·35 to 0·7 by 0·008 mm.

(2) Smooth styli ; size 0·2 by 0·015 mm.

(3) Curved oxea ; size 0·2 by 0·007 mm.

EXPLANATION OF PLATE XLV.

Fig. 19.—*Rhaphidophlus tenebratus*, Whitelegge.
Fig. 20.—*Dendoryx fusca*, Whitelegge.—See p. 481.
Fig. 21.—*Stylostichon conulosum*, Whitelegge.
Fig. 22.—*Paresperella repens*, Whitelegge.
Fig. 23.—*Clathria multipora*, Whitelegge.
Fig. 24.—*Dendoryx pumicea*, Whitelegge.—See p. 480.
Fig. 25.—*Echinochalina reticulata*, Whitelegge.
Fig. 26.—*Esperiopsis ferruginea*, Whitelegge.—See p. 472.
Fig. 27.—*Clathria striata*, Whitelegge.
Fig. 28.—*Allantophora plicata*, Whitelegge.
Fig. 29.—*Rhaphidophlus arcuophora*, Whitelegge.
Fig. 30.—*Dendoryx pumicea*, Whitelegge.

(All the figures are about one-third natural size.)

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

[Part II]

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ECHINODERMATA.

By HUBERT LYMAN CLARK.

ECHINODERMATA.

By Hubert Lyman Clark.

(Plates xlvii.-lviii.)

The collection of Echinoderms made by the "Thetis" is not very extensive, containing, as it does, only eight hundred and seventy-five specimens, representing fifty-four species, with five hundred and forty-eight of the specimens belonging to four species. In spite of the small size of the collection it is of great scientific interest, not merely because eighteen of the species have not hitherto been described, but also because of the new light which it throws on the breeding habits of some species and the distribution of certain genera. The specimens sent me represent only twenty-five stations of the fifty-nine occupied by the "Thetis"; there are, however, in addition, forty-two specimens from Lord Howe Island, representing thirteen species, and a few labelled "near Sydney," "Barrenjoey," or "off Broken Bay." The stations which revealed the richest Echinoderm fauna (aside from Lord Howe Island) were 57, off Wata Mooli, 54-59 fathoms, where nine species were taken; 13, off Cape Three Points, 41-50 fathoms, where nine species occurred; and 48, off Wollongong, 55-56 fathoms, where eight species were found. At stations 10, 36, 44 and 54, five or more species were collected.

The specimens from Lord Howe Island are of particular interest, because when considered in the light of previous knowledge they furnish us with a fair idea of the Echinoderm fauna of that isolated islet. In 1887 the Trustees of the Australian Museum sent a party to Lord Howe Island for the purpose of extending our knowledge of its geology and zoology. In Mr. R. Etheridge's (junior) report on "The General Zoology of Lord Howe Island,"[1] which was based chiefly upon the work of this party, of which he was a member, the following Echinoderms are recorded from the island.[2]

Asterias calamaria, Gray.
Asterina exigua, Lamk.
Ophidiaster germani, Per.
Patiria crassa, Gray.
Ophiocoma breviceps, Peters.

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[1] Etheridge—Austr. Mus. Mem. ii., 1, No. 1, 1889, pp. 36-39.

[2] The names are reprinted here exactly as they are given, regardless of typographical errors.

Ophiocoma crenacea, M. and T.
Phyllacanthus, perhaps *baculosa*, Lamk.
Centrostephanus Rodgersii, A. Agass.
Echinometra lucunter, Leske.
Strongylocentrotus tuberculatus, Lamk.
Echinostrephus molare, A. Agas.
Tripneustes angulosus, Leske.
Echinoneus cyclostomus, Leske.
Breynia australasiæ, Leach.
Holothuria, "probably allied to the 'milk-fish.'"
"perhaps" *Holothuria vagabunda*, Selenka.
Stichopus chloronotus, Brandt.
Cucumaria, "of a pale straw-yellow."

While the "Thetis" collection does not actually add to this list, it does throw light on some of the doubtful species. Thus, the Holothurian referred to as "allied to the milk-fish," is probably *H. difficilis*, Semper; while the "*Stichopus chloronotus*, Brandt," is probably *H. macleari*, Bell; and the "perhaps *Holothuria vagabunda*, Selenka," is probably *H. fusco-cinerea*, Jäger. The reasons for each of these identifications will be given under the various "Thetis" species. Of the Ophiurans given above, each is so unfortunate as to have its name misprinted, *Ophiocoma brevipes* and *erinaceus* being intended. The f[illegible]as taken by the "Thetis," but the common species of Ophiuran appears to be *Ophiocoma scolopendrina*, Lamk. Whether *erinacea* is really distinct from the latter is still a debatable question, but granting that it is, none of the specimens from Lord Howe Island before me are to be referred to that form. As for the Echini, there seems to be no revision of the list necessary, save for the change of two names. Loven in his "Echinoidea described by Linnæus"[3] has shown that the Indo-Pacific Echinomet[illegible] should be called *mathæi*, and the Tripneustes from the sa[illegible] *ratilla*. Of the star-fishes, "*Patiria crassa*" appears to be, without doubt, the new species of Henricia brought back by the "Thetis." There is some reason for doubting whether the Ophidiaster from Lord Howe Island is really identical with *germani*, Perrier, but until more material is available it may well be left under that name. There can be little doubt that further collecting will reveal other species of Ophiurans and Holothurians, but the species of Echinoderms now known to occur at Lord Howe Island number eighteen, as follows :—

Asterina exigua (Lamk.). Common under rocks.
**Ophidiaster germani*, Perrier. Rather uncommon.

[3] Loven—Bih. K. Svenska Vet.-Akad. Handl., xiii., Afd. 4, No. 5, 1887.
* Collected by the "Thetis."

**Henricia heteractis*, sp. nov. Apparently not rare.
**Coscinasterias calamaria* (Gray). Very common.
**Ophiocoma brevipes*, Peters. Not uncommon.
**Ophiocoma scolopendrina* (Lamk.). Common; *O. erinacea*, M. & T., may occur with it.
Phyllacanthus, sp.? Apparently rare.
**Centrostephanus rodgersii* (A. Ag.). Not uncommon.
**Echinometra mathaei* (Bl.). Very common.
**Strongylocentrotus tuberculatus* (Lamk.). Common.
Echinostrephus molaris (Bl.). Of very doubtful occurrence.
**Tripneustes gratilla* (L.). Not uncommon.
Echinoneus cyclostomus (Leske). Apparently not common.
**Breynia australasiæ* (Leach). Abundant in the lagoon.
**Holothuria difficilis*, Semper. Common.
**Holothuria fusco-cinerea*, Jäger. Common.
**Holothuria macleari*, Bell. Rather common.
Cucumaria, sp.? Apparently rare.

It would be interesting to give here a similar revised list of the Echinoderms of New South Wales, but as the "Thetis" collection contains only twenty-five of the considerably more than one hundred species previously known from that region, it would be presumptuous to attempt it with the material which is available to me at the present time.

The following are the new species described in this report. The one marked with an asterisk is not from the "Thetis" collection, but its relationship to one of the "Thetis" species is so close it was necessary to name it in order to refer to it for comparison. The type-specimen is in the collection of the Museum of Comparative Zoölogy at Cambridge, Mass. The types of all the other species are in the Australian Museum, but, except in the case of those species marked with a dagger, co-types are deposited in the M. C. Z. collection:—

Oligometra thetidis.
Himerometra pædophora.
Henricia heteractis.
Coscinasterias dubia.
Pectinura dyscrita.
Ophiozona gymnopora.
Ophiura ctenophora.
Amphipholis australiana.
**Amphipholis lævidiscus*, Chili, "Hassler" Expedition.
Ophiacantha heterotyla.
†*Ophiopristis axiologus.*
Ophiothrix acestra.

†*Astroporpa australiensis.*
†ASTROTHROMBUS (gen. nov.) *rugosus.*
Conocladus amblyconus.
Chætodiadema tuberculatum.
Fibularia nutriens.
Molpadia dissimilis.
Molpadia productamensis.

The study of this collection has been most interesting, and I desire to express here my thanks to the Trustees of the Australian Museum for the honour they have done me in entrusting it to my care. I wish, further, to express my great obligation to Mr. Etheridge for his constant courtesy, which has made possible the publication of the report in so short a time and so satisfactory a manner, in spite of the great distance that has separated us. I take pleasure also in acknowledging the patience and skill with which Miss Dandridge has succeeded in making accurate drawings of the Ophiurans, many of which were either so small or so badly broken, that good figures seemed almost impossible.

CRINOIDEA.

Although there are only three species of Crinoid represented in the collection, two of these appear to have been hitherto undescribed, and both are of rather more than usual interest. Mr. Austin Hobart Clark kindly examined much of the material and assisted in its identification, and I wish to express here my thanks to him for this aid and for many helpful suggestions. I have also followed the guidance of his published papers in writing my descriptions, in order that mine should be uniform with his. I have adopted his recently proposed genera without hesitation, not merely because his unusually extensive knowledge of the class justifies such a course, but because his classification appeals to me, on the whole, as being very natural. I regret to add that we do not agree on the status of *Himerometra pædophora*.

OLIGOMETRA THETIDIS,[4] sp. nov.

(Plate xlvii., figs. 1, 2, 3.)

Centro-dorsal small, low hemispherical, nearly concealed by two marginal rows of cirri; these (Pl. xlvii., fig. 3) are about sixteen in number, 7-8 mm. long, with fifteen-eighteen joints besides the claw; basal joints wider than long, but distally they are squarish; each

[4] *Thetidis* = of the "Thetis."

one, beginning with the fourth, has, at middle of dorsal side, a transverse ridge, which in side-view looks like a spine, that of the terminal joint being distinctly the largest, but even here not nearly equalling thickness of joint; on basal joints dorsal ridge somewhat serrulate, while distal margin of joint projects as a more or less evident second ridge; in consequence of this arrangement, the dorsal side of some joints, notably fifth-eighth, appears as though provided with two low spines, one nearly at middle and one distal; terminal claw, usually sharp, curved and scarcely as long as penultimate joint. Radials plainly visible, but short; first costals oblong, fully twice as wide as long, in apposition and slightly flattened on proximal half of lateral edges; costal axillaries pentagonal, much wider than long. Ten arms, rather more than 25 mm. long; first brachials nearly oblong, much wider than long, more or less in contact proximally, outer side somewhat longer than inner; second brachial similar, but relatively longer; third and fourth brachials taken together as long as wide, squarish; fifth and sixth decidedly wider than long; the following nine or ten more or less wedge-shaped, but succeeding ones rather irregular; on distal part of arm the most distal portion of the distal edge of each brachial tends to project, though not sufficiently to be called a spine or even a tubercle. Syzygia occur between the third and fourth, and between the sixth and seventh, or rarely seventh and eighth brachials, and then at intervals of three oblique muscular articulations. First pinnule (Pl. xlvii., fig. 1) nearly 6 mm. long, with ten-twelve joints, the first about as long as wide, second a little longer, third twice as long as wide, fourth and fifth about the same, the succeeding gradually decreasing in length, so that the minute terminal joint is scarcely longer than thick; all the joints are semi-cylindrical, smooth, furrowed on the inner face; second and third pinnules shorter, with only seven or eight joints, but otherwise similar; succeeding pinnules somewhat longer, those at middle of arm (Pl. xlvii., fig. 2) with as many as fifteen joints, of which the third, fourth and fifth are flattened and have conspicuously flaring margins: distal pinnules all somewhat broken. Sacculi more or less abundant, especially in distal pinnules. Colour, in alcohol, cream-colour, sometimes uniform, but usually with more or less distinct markings of purple; very rarely the entire animal is dull purplish, lightest towards the tips of the arms.

Fifteen specimens from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

This species is closely allied to *adeonæ*, Lamk., and *bidens*, Bell, but seems to be distinguished from either by the characteristic expansion of the genital pinnules. It differs from *adeonæ* further, in its smaller size, shorter first pinnules, and fewer cirri with

fewer joints; the latter also appear to be rougher on the dorsal side. It differs from *bidens*, moreover, in the complete absence of the tubercles on the costals and lower brachials, in having a syzygy in the sixth or seventh brachial (though this is of little importance), and in somewhat different lower pinnules. Unfortunately, there is some uncertainty about the pinnules of *bidens*, as described by Bell[5]; he says the first one has "some twelve joints," with "the most proximal joint the longest," while the figure given shows fourteen joints, the third and fourth decidedly the longest. In view of our imperfect view of *adeonæ*, and the obvious resemblance between that species and both *bidens* and *thetidis*, it seems to me quite possible that more abundant material will show that the three names belong to a single species.

HIMEROMETRA PÆDOPHORA,[6] sp.nov.

(Plate xlvii., figs. 4-10.)

Centro-dorsal small, discoidal, carrying only a single series of cirri, of which there are only ten-fifteen; these (Pl. xlvii., fig. 10) are about 10 mm. long, with twenty-five-thirty-five (usually twenty-eight-thirty) joints; first four basal joints wider than long, but all succeeding joints about as long as wide; joints all smooth or nearly so, until near tip of cirrus, where a slight longitudinal keel is barely developed on dorsal side of each joint; in some cases this keel gives rise to a slight spine, but even on penultimate joint no conspicuous spine is found; terminal claw short and blunt. Radials barely visible; costals not at all swollen or peculiar in any way; first costals much wider than long, narrower proximally than distally, perfectly smooth, and distinctly separated from each other; costal axillaries smooth, much wider than long, with lateral edges very short, and distal edges slightly concave. Ten arms, 17-19 mm. long; first brachials wider than long, outer edge somewhat longer than inner, which touch each other at least proximally; second brachials similar, but distal margin not so straight; third and fourth brachials equal, discoidal, united by syzygy, the two together about as long as wide; succeeding joints more or less oblong, the outer and inner sides usually slightly differing in length. Syzygia occur between the third and fourth, seventh and eighth, eleventh and twelfth

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[5] Bell—Zool. Rep. "Alert" 1884, p. 158, pl. xi., fig. A b. See also Döderlein, 1898, in Semon's Zool. Forch. Austr. v., 4, p. 476, pl. xxxvi., figs. 3-3*d*.

[6] παῖς = child + φορέω = to carry, in reference to the carrying of the pentacrinoid larvæ, on the pinnules.

(rarely tenth and eleventh), and subsequently at intervals of two, or more commonly one, oblique muscular articulations. All the brachials are smooth and rounded dorsally, and not only do the plates not overlap, but they are scarcely in contact (except at syzygies, of course). Pinnules rather few, twelve-fifteen on each side of an arm, widely spaced, owing to length of arm-joints and frequent syzygies. First pinnule (Pl. xlvii., fig. 4) stout, borne on second brachial, 2-3 mm. long, of seven joints, which are smooth and semi-cylindrical; first two about as wide as long, third, fourth and fifth longer than wide; terminal joint minute, blunt. Second pinnule (Pl. xlvii., fig. 5) borne on fourth (epizygal) brachial, very short, about a millimeter long, of only four joints; succeeding pinnules (Pl. xlvii., fig. 6) less stout, with eight-fourteen joints, the basal ones large but only a little expanded laterally. Sacculi abundant and large, especially in distal pinnules; very few on disc. When dry, the disc shows many small calcareous plates, largest and most conspicuous beside the ambulacral furrows and around the base of the anal tube, which is about as long as half the diameter of the disc, or longer. The oral surface of arms and pinnules seem to be free from plates. Colour of skeleton, very light brown; of soft parts and sacculi, very dark brown; terminal half of cirri with more or fewer of the joints marked dorsally, or strongly tinged with purple.

Twenty-three specimens from Station 28. Off Manning River, 22 fathoms; fine grey sand.

All of the individuals of this species were found tightly clinging by their cirri to the pinnules and cirri of the larger specimens of *Pt. macronema*, of which species they were, at first, supposed to be the young. One specimen of *macronema* carried no less than seven individuals. While it is quite possible that the entanglement took place in the dredge, the appearance of the specimens indicates that the smaller species lives symbiotically with the larger. Mr. A. H. Clark[7] has reported a somewhat similar association of a *Heliometra* (*H. brachymera*, A.H.C.) with a much larger species (*H. eschrichtii maxima*, A.H.C.) of the same genus in the Sea of Japan. More remarkable than this association with *macronema* is the fact that all the larger specimens of *pædophora* carry pentacrinoid larvæ attached to their pinnules; the type-specimen bore no less than twenty-four such young. The youngest stage observed (Pl. xlvii., fig. 7) has a short, rather fleshy stalk, with a large attaching disc at one end, and the somewhat ellipsoidal body at the other; at this stage the joints of the stalk appear as more or less discoidal plates, while the body-wall

[7] Clark—Proc. U. S. Nat. Mus., xxxiii., 1907, p. 76.

contains ten large plates, five orals and five basals; no radial plates are visible. In a specimen a trifle older the radials have arisen in the space bounded by two oral and two basal plates, and the stem-joints are not so discoidal. At a still later stage (Pl. xlvii., fig. 8) the radials are conspicuous, though the orals and basals are equally prominent, the first costal and the costal axillary appear as rather elongated plates, and the arms consist of two or three joints; the stem, which is relatively far more slender than at the earlier stage, consists of ten-twelve joints, of which the middle ones are longer than wide, and are encircled at the mid-zone by a conspicuous ridge, a possible indication of a circle of cirri in some ancestral form. A similar ridge occurs on the stem-joints of *Metacrinus cingulatus* (and other species of the genus), where it appears to be purely ornamental. The older stages (Pl. xlvii., fig. 9) have the stem and attaching disc of approximately the same actual size, as earlier, and therefore relatively much smaller; the stem-joints have lost the encircling ridge and are practically smooth; the basals are relatively small, but the orals are still conspicuous; the cirri have begun to appear on the margin of the centro-dorsal; they have a variable number of joints, of course; and are very erect, parallel with the arms; the latter have elongated and the brachials are well defined; no syzygies are to be found, but the third and fourth plates appear to be somewhat closer together than the others. In the earliest free-swimming stage which I have found, the arms are about 7 mm. long, and have about nine pinnules on each side; distinct syzygies are present between brachials three and four, seven and eight, and eleven and twelve, but in the remaining sixteen-eighteen joints syzygies have not yet developed; the first pinnule has only four or five joints, but is somewhat stouter than the succeeding; there are six cirri, each with about thirty joints. Basal plates can no longer be distinguished, and the oral plates are reduced to a few large irregular fragments in each interradius of the disc. The transition from this stage to the adult condition is obvious.

I have placed this interesting species in the genus *Himerometra*, only after considerable hesitation on account of its small size, the absence of any swelling or convexity on the costals, and the very small number of cirri. It resembles *Oligometra* in many respects, but the large number of cirrus-joints distinguishes it from the species of that genus. It has seemed to me better to include it in the large and somewhat heterogenous group, Himerometra, rather than to modify the definition of a smaller, natural genus like *Oligometra*.

It might be thought that we have here simply a young form of *Ptilometra*, especially as these specimens occur only with the adults of that genus. Fortunately, however, there are young

specimens of *Ptilometra* in the collection as small as the larger specimens of *pædophora*, and it is possible, therefore, to show that the two are not even nearly allied forms; the conical centrodorsal, the long cirri and the crowded prismatic pinnules distinguish the Ptilometras at a glance. Moreover it should be noted that pentacrinoid larvæ were not present on the pinnules of any undoubted *Pt. macronema*, even among those from Station 28. It is difficult for me to believe that the smallest Ptilometras, too young to have assumed any of their characteristic generic or specific features, should be the only ones which are breeding. In conclusion, I can only say that while I am perfectly sure these Comatulids are not Ptilometras, I am very much in doubt as to their real systematic position. I think it most unlikely that they are really Himerometras, but I do feel reasonably sure that they belong in the family Himerometridæ.

PTILOMETRA MACRONEMA.

Comatula macronema, J. Müller, K. Akad. Berlin Monatsb., 1846, p. 179.

Ptilometra macronema, A. H. Clark, Smithson. Misc. Coll., 1907, (Quarterly Issue), L, 3, p. 358.

4 specimens from Station 10. Off Broken Head, 28 fathoms; fine sand.

14 specimens from Station 12. Off Cape Three Points, 23-34 fathoms; sand.

26 specimens from Station 28. Off Manning River, 22 fathoms; fine grey sand.

11 specimens from Station ?

The smallest of these specimens has the ten arms only 16 mm. long, but nevertheless shows the adult specific characters fairly well; the centrodorsal is markedly conical, the ten cirri have each about forty joints and the pinnules are decidedly prismatic. In the largest specimen, there are eighteen arms which are 60 mm. long, and the cirri have over seventy joints. The colour of all the specimens is brown, but the shade varies considerably, some individuals being decidedly purplish, while others are yellowish, or more rarely somewhat reddish.

ASTEROIDEA.

The fifty starfishes in the collection represent but nine species, of which only two have previously escaped description, the others being for the most part well-known forms. Aside from the new *Henricia*, the collection throws no light on the question of distribution, and it contributes nothing to our knowledge of the natural history of any of the species, except the changes due to growth in one of the common Astropectens of New South Wales.

ASTROPECTEN PECTINATUS.

(Plate xlviii.)

Astropecten pectinatus, Sladen, Journ. Linn. Soc., Zool., 1883, xvii., p. 251.

1 specimen from Station 21. Newcastle Bight, 28-40 fathoms; fine grey sand.

7 specimens from Station 25. Off Newcastle, 42-48 fathoms; soft mud.

1 specimen from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

1 specimen from Station 41. Off Wata Mooli, 52-71 fathoms; soft mud.

1 specimen from Station 52. In Shoalhaven Bight, 19-20 fathoms; sand to mud.

5 specimens from "off Broken Bay" (? Station 13).

This series of specimens, ranging in diameter from 55 to 175mm, is of particular interest, because it shows that the specimens upon which Sladen based his species were only half grown and that the fully grown individuals (Pl. xlviii., figs. 1-2) are so different, they have long passed under another name. In the small specimens, R=3·5r; in specimens with R=60-80 mm., R=4-4·5r; and in large specimens, R equalling about 100 mm., R=5r. Moreover, in young specimens the rays taper to quite a slender point, while in the adult they are proportionately much wider at the tip. In the adults also the outer spine of the series on each inframarginal plate is greatly enlarged and much more conspicuous than in the young. In consequence of these changes, the general facies of the adult is entirely different from that of the young, and if one compares an adult specimen with Sladen's[8] figures, it seems incredible that the two are really the same species.

This seems to be a common species in water of moderate depth off the coast of New South Wales, and the adult specimens were identified, twenty years ago, by Mr. Thomas Whitelegge[9] as *Astropecten triseriatus* M. & T. As they do not have three series of spines (or tubercles) on the superomarginal plates, they cannot be that species, and it is fortunate that the "Thetis" collection enables us to determine what they really are. Specimens labelled "*Astropecten triseriatus*, M. & T." have been sent out in exchange by the Australian Museum, and it is therefore important to call

[8] Sladen—Chall. Report, Zool., xxx., 1889, Pl. xxxiii., figs. 3-4.
[9] Whitelegge—Journ. Roy. Soc. N.S. Wales, xxiii., 1889, p. 200.

attention here to the fact that they are really *A. pectinatus* Sladen. Aside from the differences between young and old, Sladen's description answers very well even for very large specimens. It may be mentioned, however, that the adambulacral armature even in small specimens, often has four and rarely five spines in one or more of the three rows of which it is composed. All of the specimens before me are light brown, but there is no clue as to what the colour may have been in life.

LUIDIA FORFICIFER.

Luidia forficifer, Sladen, Chall. Report, Zool., xxx., 1889, p. 258.

One specimen from Station 21. Newcastle Bight, 28-40 fathoms; fine grey sand.

This specimen, 125 mm. in diameter, ashy-grey in colour, shows no important differences from Sladen's description.

LUIDIA MACULATA.

Luidia maculata, Müller and Troschel, Syst. der Ast., 1842, p. 77.

Three magnificent specimens of this species, without any indication of locality, are in the collection. They are handsomely variegated with dull black and yellow, and each has seven arms. In the largest, R=250 mm.

NECTRIA OCELLIFERA.

Asterias ocellifera, Lamarck, Anim. sans Vert., ii., 1816, p. 553.
Nectria oculifera (sic) Gray, Ann. Mag. Nat. Hist. vi., 1840, p. 287.
Nectria ocellifera, Dujardin et Hupé, Echinodermes, 1862, p. 406.

One specimen from Station 56. Off Botany Bay, 79-80 fathoms; sand and stones.

One specimen from Station ?

Both of these specimens are very fine adults, with R=130 mm. Their colour is dark brown.

OPHIDIASTER GERMANI.

Ophidiaster germani, Perrier, Arch. Zool. Exp., iv., 1875, p. 394.

One specimen. Lord Howe Island.

This specimen is very pale fawn-colour, and has R=67 mm. I refer it with some hesitation to Perrier's species, for while it answers well to his description, it has one character, not men-

tioned by him, which is so conspicuous he could hardly have overlooked it had it been present in his specimens; the first fourteen-sixteen large adambulacral spines of the outer series, beginning at the mouth, are so closely arranged that the distance between two is far less than the diameter of one, while the remainder are widely spaced, the distance between two greatly exceeding the diameter of one; the transition from the crowded to the open arrangement is abrupt and marked. Should this prove to be a constant character in the Ophidiasters from Lord Howe Island, it would probably entitle them to full specific rank. But it is possible it is only an individual peculiarity of the specimen before me.

HENRICIA HETERACTIS,[10] sp. nov.

(Plate xlix., figs. 1 and 2.)

Rays 7 (in two smaller specimens 6). R=25 mm., r=8 mm., R=3r. Interbrachial arcs acute. Rays more or less cylindrical, stout and very blunt. Breadth at base, 7·5 mm. Disc rather large; vertical diameter, 7 mm. Plates of abactinal skeleton stout and crowded, more or less crescentic, with the concave side towards the centre of the disc. Along the sides of the rays, especially near tip, a more or less distinct, longitudinal arrangement can be seen. Papular areas reduced to a minimum, each with a single rather large papula. Spinelets very numerous on all the abactinal plates, minute and very slender; in the interbrachial arcs the spinelets are longer and less crowded. Actinal surface of rays flattened, closely covered by three or four longitudinal series of squarish plates on either side, each bearing a dense covering of minute spinelets, only a little larger than those of the abactinal surface. Adambulacral armature (Pl. xlix., fig. 1) consists of a marginal series of five or six spines, more or less connected by a membrane, the middle one or two about 1 mm. long and decidedly longer and stouter than the others; the aboral and adoral ones the smallest. Just outside, and close to this marginal series is another very similar set of four or five spines; these are a trifle shorter but fully as stout, and are hardly as much united to each other by a membrane. The adambulacral plates are well spaced, and their adoral and aboral margins bear a few small spinelets which may form a continuous series with the outer marginal series. The surface of the plate carries from one to four short, sharp spines. *There is no furrow spine.* Oral

[10] ἕτερος=other than usual+ἀκτίς=a ray, in reference to the number of rays.

plates each with four large marginal spines, the innermost the largest. Madrepore plates, in type specimen, present in each interradius, of very irregular form and size. In the other specimens, however, only a single, very small, somewhat triangular madrepore plate was found. Colour in alcohol, and dry, light brown. Under a magnification of seventy diameters, all the spines and spinelets are found to be very thorny at the tip.

Five specimens. Lord Howe Island.

In the type specimen, which is the largest, the seven rays are only slightly unequal, and in a second, much smaller, specimen there are six nearly equal rays. In the other specimens, however, there is great diversity in the relative size of the rays; one has two large and four smaller rays, a second has four large and three very much smaller rays, and the third has four large and three very minute rays, which are only visible actinally. These last two specimens would seem to show that this *Henricia*, like some species of *Stichaster*, reproduces by fission, for in both cases the large and small rays form separate groups on opposite sides of the animal.

There can be no doubt, I think, that this is the starfish referred to by Etheridge[1] as "*Patiria crassa*, Gray," which he describes as "somewhat solariform, with six or seven rays, and grey in colour." The known species of *Patiria* have only five rays, and they are structurally quite different from this species from Lord Howe Island. In all essentials this form is a typical *Henricia* except in the complete absence of a furrow spine. In this particular it agrees with the nearly related *Perknaster*, Sladen, but its general facies is utterly unlike the species of that genus. It does not seem to me advisable, however, to base a new genus upon this character (or perhaps more properly, lack of character), even though it is combined with an unusual number of rays. It is interesting to note that while four species of *Henricia* (each having five rays and furrow spines) are known from the New Zealand region, the genus has not hitherto been reported from Australian waters.

COSCINASTERIAS CALAMARIA.

Asterias calamaria, Gray, Ann. Mag. Nat. Hist., vi., 1840, p. 179.
Coscinasterias muricata, Verrill, Trans. Conn. Acad. i., 2, 1867. p. 248.
Coscinasterias calamaria, Perrier, Exp. "Trav." et "Tal." Echinod., 1894, p. 106.

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[1] Etheridge—Austr. Mus. Mem., ii., 1, No. 1, 1889, p. 39.

3 specimens from near Sydney.

2 specimens from Lord Howe Island.

It is interesting to note that while the specimens from near Sydney have eleven rays each, those from Lord Howe Island have only seven. It would be much more interesting to know what the average number is for each locality and what degree of variation is shown. This would afford an admirable subject for a biometrical investigation.

COSCINASTERIAS DUBIA,[12] sp. nov.

(Plate xlix, figs. 3 and 4; pl. l.)

Rays 5. R=83 mm., r=16 mm., R=5r. Interbrachial arcs acute. Rays somewhat flattened (markedly so in dried specimens), with sides vertical and actinal surface sharply marked off. Breadth of ray near base, 20 mm. Disc moderate or small vertical diameter, 9 mm. Rays slightly constricted where they join disc. Whole abactinal surface provided with conspicuous slender spines, 3-5 mm. high, each surrounded at its base with a dense wreath of minute pedicellariæ. There are about twenty of these spines on the disc, where they are smaller than those on the rays. The latter are arranged in five fairly regular longitudinal series, the median one containing about thirty spines, the marginal about twenty each, and the intermediate about ten each. Abactinal skeleton rather stout, with relatively small spaces, each showing about half-a-dozen papulæ or fewer. At base of arms and on disc, scattered irregularly among the spines, are large solitary pedicellariæ (Pl. xlix., fig. 2) about 2 mm. long. Similar pedicellariæ, but scarcely half so large, occur on many of the wreaths of minute pedicellariæ surrounding the spines (Pl.xlix., fig. 3). Adambulacral armature consists of two more or less cylindrical spines about 3 mm. long, standing one directly outside the other, so that two very distinct rows of adambulacral spines are conspicuous. Near the mouth, these spines are larger and are decidedly flattened at tip. Actinal surface of ray, outside of adambulacral armature, more or less covered by three series of spines, so arranged as to form oblique rows of two or three each, of which the marginal is decidedly the largest and most adoral. These marginal spines are about 5 mm. long, and for fully half their length are united to each other by a membrane, which thus forms a conspicuous marginal fringe to the actinal surface of the ray. Each spine is very much flattened and widened at the tip

[12] *dubia*=doubtful, in reference to the close resemblance to *Asterias eustyla*.

and deeply furrowed on the actinal side. A large cluster of pedicellariæ covers about one half of the upper side of each spine; these clusters spread somewhat on to the membrane between the spines, but scarcely extend on to the actinal side. The series of spines just below the marginal fringe is placed close to the latter, but the spines are somewhat shorter and more slender, are not connected with each other by any membrane, and carry no pedicellariæ. The third series of spines does not begin quite so near the base of the ray as the other two, and extends only to within 15 or 20 mm. of the tip. These spines are decidedly smaller than those of the second and marginal series, but are much stouter than the adambulacral spines. They are much less numerous than the latter, however, for at the middle of the ray there are three adambulacral spines to each one of the third actinal series. Oral plates, each with two marginal spines at the inner end, of which the inner one is much the larger. A still larger superoral spine is present on each plate, and there are also two or three very large but slender pedicellariæ at the inner end. Madrepore plate 3 mm. in diameter, free from spines, situated nearer the margin than the centre of the disc. Colour of alcoholic, and dry, specimens deep yellowish-brown.

3 specimens from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

1 specimen from Station 44. Off Coogee, 49-50 fathoms; fine sand.

10 specimens from Station ?

This species is surprisingly near *Asterias eustyla*, Sladen, known only from the vicinity of Tristan da Cunha. In a specimen of *dubia* of the same size as the only known specimen of *eustyla* (R=60 mm.), the following differences are obvious: the rays of *dubia* are much broader and the disc larger than in *eustyla*, r=11 instead of 7 mm. and br.=13 mm. instead of 8 or 9; there are in *dubia* only two series of inferomarginal spines, which are much flattened and with a deep longitudinal furrow on the actinal side, and there is a considerable space between these spines and the adumbulacral series, while in *eustyla* there are three series of spines, only slightly flattened and not furrowed, and closely crowded against the adambulacral series; finally, the adambulacral spines are longer and the large forficiform pedicellariæ are more numerous in *dubia* than in *eustyla*. From *Asterias mollis*, Hutton, of New Zealand, *dubia* may be at once distinguished by the blunt and only slightly tapering rays, the much heavier skeleton, the much larger wreaths of pedicellariæ, the much larger but more slender forficiform pedicellariæ and the more numerous inframarginal spines; the general facies of the two forms is thus

quite different, at least so far as one can judge from Museum specimens. It seems somewhat strange that such a large and apparently common starfish should have escaped notice hitherto, but it is quite possible that specimens have been regarded as 5-rayed examples of *calamaria*, the superficial resemblance to that species being quite obvious. But *dubia* is markedly "dip acanthid" in its adambulacral armature, not "*monacanthid*" as is *calamaria*; if one considers the feature of generic value, *dubia* belongs to Perrier's genus "Distolasterias." For my part, I do not consider the character either important enough in itself, or sufficiently reliable in all cases, to warrant the recognition of that genus.

UNIOPHORA GLOBIFERA.

Uniophora globifera, Gray, Ann. Mag. Nat. Hist., vi., 1840, p. 288.

Three specimens, without locality.

Aside from the fact that one of the specimens has six rays, they are of no particular interest, as they are not full grown, are rather poorly preserved (dry) and give no indication as to where they were taken.

OPHIUROIDEA.

The large series of Ophiurans, representing nineteen species, is of great interest, not merely because ten species appear to be new, but because some very peculiar facts in distribution are brought to light. Thus the two species of *Ophiocoma* which appear to be common at Lord Howe Island are not represented in the material from the coast of New South Wales, while none of the seventeen species from New South Wales were found at Lord Howe Island. A very remarkable fact is the occurrence in Australian waters, of an *Astroporpa*, a genus known hitherto only from the West Indian region. The collection thus adds very materially to our knowledge of Australian Ophiurans.

PECTINURA DYSCRITA,[13] sp. nov.

(Plate xlix., figs. 5, 6, 7.)

Diameter of disc, 10 mm.; length of arm, 45 mm. Disc flat, distinctly pentagonal, completely covered by a coarse granulation, about 125 granules to a square millimeter, at centre, and about 70 at interradial margin; radial shields entirely covered. Upper

[13] δύσκριτος = hard to determine, in reference to the perplexity afforded by this, among other species of Pectinura.

arm-plates oblong, with rounded corners, about two-thirds as long as wide. Interbrachial spaces below closely granulated. Oral shields somewhat wider than long, with a nearly straight distal margin, but strongly convex proximally. Adoral plates small and bare. Oral plates concealed by a coarse granulation, about 30-35 granules on each jaw. Oral papillæ about seven on each side, penultimate decidedly largest. Under arm-plates nearly octagonal but with distal angles rounded, a trifle longer than wide; first under arm-plate triangular, much wider than long, without pores between it and second plate. Side arm-plates rather larger, with a strongly convex distal margin, but well separated from each other throughout the whole length of arm; each plate carries six (very rarely seven) spines, of which the lowest is more or less cylindrical and blunt, and about two-thirds as long as joint; the others are a trifle shorter, and are flatter and pointed; the uppermost is clearly the smallest. Tentacle-scales two, the outer decidedly wider than the inner, but, except on basal joints, hardly more than half as long. Colour (dry) very light brown, with a greyish cast on the upper side; under arm-plates and oral shields nearly white; dorsal side of disc and upper arm-plates, indistinctly clouded with purple, and faintly marked with a few very small, round, whitish spots.

1 specimen from Station 42. Off Wata Mooli, 70-78 fathoms; coarse sand.

1 specimen from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

It is not a little exasperating, after having just completed a careful revision of the genus Pectinura and its allies,[14] to find these two specimens, which agree in being unlike any of the previously known species! They are nearly related to *P. assimilis*, Bell, but the smaller number of arm-spines distinguish them from that species at a glance, for in specimens of *assimilis* of the same size as the larger specimen of *dyscrita*, there are at least eight or nine arm-spines on the basal joints. I see no other course open, therefore, than to regard them as representing a previously unknown species.

OPHIOZONA GYMNOPORA,[15] sp. nov.

(Plate li., figs. 1-3.)

Diameter of disc, 3 mm.; length of arm, 4 mm. Disc flat, covered by about sixty plates, among which the central dorsal,

[14] Clark—Bull. Mus. Comp. Zoöl., lii., 1909, pp. 111-132.

[15] γυμνός=naked+πόρος=a way through, a pore, in reference to the absence of the tentacle-scales.

five radial primary plates and ten radial shields are conspicuous. Radial shields much larger than central dorsal plate, decidedly longer than wide, broadly in contact, only the proximal ends being slightly separated by one or two small scales; there is a single interradial marginal plate, wider than long, between each two pairs of radial shields. Upper arm-plates broadly triangular, much wider than long, with convex distal margin and rounded outer corners; somewhat swollen; all, or all but first two or three, separated by side arm-plates. Interbrachial spaces below covered with a rough pavement of very large, coarse granules, in marked contrast to the plates of the upper side. Genital slits wholly wanting. Oral shields wider than long, with straight distal and lateral margins, the latter parallel to each other; proximal margin with an angle inwards. Adoral plates rather large, somewhat swollen, about as wide as long. Oral plates indistinct. Oral papillæ closely fused, apparently two or three on each side and a very large one at apex of jaw. Under arm-plates swollen, about as wide as long, pentagonal with a sharp proximal angle and rounded distal angles, all except first two separated by side arm-plates; first under arm-plate decidedly longer than wide, its outer end wider than inner. Side arm-plates large, swollen, meeting above and below, except at very base of arm; each plate carries two minute, stout, pointed spines, about half as long as joint, or more, the lower the longer. Tentacle-scales, none, except a very minute one on inner distal side of first pore; pores very large. Colour (in alcohol) pale yellowish or whitish.

117 specimens from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

88 specimens from Station 22. Newcastle Bight, 26-40 fathoms; grey sand to mud and shell.

9 specimens from Station 35. Off Port Hacking, 22-38 fathoms; sandy.

10 specimens from Station 38. Off Jibbon, 46-55 fathoms; sand to mud

95 specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

This little species, which makes up three-quarters of the collection of Ophiurans, appears to be very common on suitable bottom off the coast of New South Wales. Owing to its small size, it is easily overlooked, and it is not strange that it has escaped observation and description hitherto. There is no other species with which it can be confused, the peculiar covering of the ventral interbrachial spaces, combining with the absence of tentacle-scales to separate it sharply from all other members of the genus, or even of the family.

OPHIURA CTENOPHORA,[16] sp. nov.

(Plate li, figs. 4-6).

Diameter of disc, 13 mm.; length of arm, 33 mm. Disc high, slightly convex, covered by about 100-150 plates, among which the central dorsal, five radial, five interradial, five interradial marginal, and ten radial shields are easily distinguishable. Radial shields broad at outer end, but longer than wide, more or less separated proximally by two or three small plates; in young specimens they are in contact distally, but in some old ones they are separated for their entire length. Upper arm-plates in contact on basal part of arm, but on outer half or third of arm are well separated; first upper arm-plate very broadly triangular, but apparently oblong, slightly swollen, seemingly longer than broad, entirely contained between upper ends of genital plates, which conceal much of it; second plate very short, two or three times as wide as long; third plate also two or three times times as wide as long, but with a more or less convex outer margin; fourth plate more or less hexagonal, much wider than long; fifth plate (in adults) also hexagonal, but nearly as long as wide; sixth and following (sometimes as far as thirteenth) plates similar, but inner end becoming narrower; succeeding plates triangular, with a sharp proximal angle and a convex outer margin, becoming very minute at tip of arm. Upper ends of genital plates conspicuous on each side of arm, at base, rounded, very slightly swollen, as wide as or wider than first upper arm-plate; a supplementary genital plate lies between the ventral end of the genital plate and the oral shield; arm-comb begins on supplementary genital, and following edge of genital, passes up on to outer end of radial shield; it consists of about 30-35 papillæ, which are ventrally small and bead-like, but becoming broad and flat, they are gradually more and more elongated, and appear, dorsally, as slender spinelets, which are longest on upper end of genital plates; a conspicuous supplementary arm-comb of very small spinelets is developed on each side of basal upper arm-plate. Interbrachial spaces below, covered by the huge oral shields and supplementary genital plates; a few marginal plates are barely visible. Oral shields much longer than wide, with a blunt angle inward. Adoral plates longer than wide, narrower at outer end than at inner. Oral plates conspicuous, nearly or quite as large as adorals, often with a third transverse plate at tip of jaw. Oral papillæ three or four on each side, outermost widest; an infradental papilla at apex of jaw. First under-arm plate much

[16] κτείς, κτενός=comb + φορέω=to bear or carry, in reference to the highly developed arm-comb.

wider than long, much narrower proximally than distally; second similar but more nearly square; third, fourth and fifth somewhat hexagonal, but with three distal sides much longer than three proximal; sixth, seventh and eighth plates rather pentagonal, with sharp proximal angle, or somewhat heptagonal; succeeding plates triangular, or slightly pentagonal or hexagonal, about as long as wide; first five or six plates clearly in contact, and they may touch as far as the fifteenth. Side arm-plates very large, thick and projecting distally, separating upper and under arm-plates except on basal half or two-thirds of arm; each plate carries three, or sometimes four, terete, pointed spines, the next to the lowest the longest, and about half as long as a joint; when there are three spines, the third one is two or three times as far above the second as the second is above the lowest; when four are present, the fourth is usually just above the third, and is the smallest of all. Tentacle-pores conspicuous, first eight or nine with scales on both sides, but further out there are seen, on distal margin of side arm-plate, only two scales, and finally only a single one; the scales never closely resemble the arm-spines; first pore entirely distinct from mouth-slit, with about five scales on each side; succeeding pores have five (proximally) and four (distally), four and three or two, three and two, or three and one. Colour (dry), pale purplish-brown above, nearly white beneath.

3 specimens from Station 25. Off Newcastle, 42-48 fathoms; soft mud.

4 specimens from Station 28. Off Manning River, 22 fathoms; fine grey sand.

1 specimen from Station 52. In Shoalhaven Bight, 19-20 fathoms; sand to mud.

This well-marked species of *Ophiura*[17] belongs very evidently to the *variabilis* group, but does not seem to be closely allied to any of the species hitherto described. While it resembles both *lacazei* and *lienosa*, it is easily distinguished from either by the under arm-plates, the basal upper arm-plates and arm-comb, the disc-plates and the huge oral shields. It is not nearly related to any of the species of the genus hitherto known from Australia.

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[17] I have been unable to find any flaw in Bell's reasoning (Ann. Mag. Nat. Hist., (6), viii., 1891, p.339), by which he shows that the familiar name *Ophioglypha* must be abandoned in favour of *Ophiura*, while the brittle-stars included in *Ophiura* by Lyman, Verrill, et al., must bear Müller's and Troschel's name *Ophioderma*. Koehler (Bull. Sci. France et Belg, xli., 1907, p.281 and p.290) goes only half-way, using *Ophioderma*, but clinging to *Ophioglypha*. This would be most unsatisfactory even if it were justifiable, for it would leave us without a genus *Ophiura*.

OPHIOMUSIUM FLABELLUM.

Ophiomusium flabellum, Lyman, Bull. Mus. Comp. Zoöl., v., 7, 1878, p.120.

3 specimens from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

1 specimen from Station 55. Off Crookhaven River, 11-15 fathoms; sand to rock.

It is a piece of real good fortune that the "Thetis" should have taken this interesting little species, previously known from only the single specimen taken by the "Challenger." On account of its small size it might be easily overlooked, but once noted, its peculiar specific characters would prevent any mistake in identification. The "Thetis" specimens have the disc about 3 mm. in diameter, and the arms 2½ mm. long. Their colour is nearly white.

OPHIACTIS RESILIENS.

Ophiactis resiliens, Lyman, Bull. Mus. Comp. Zoöl., vi., 2, 1879, p. 36.

9 specimens from Station 10. Off Broken Head, 28 fathoms; fine sand.

16 specimens from Station 44. Off Coogee, 49-50 fathoms; fine sand.

1 specimen from Station 54. Within Jervis Bay, 10-11 fathoms; seaweed and sand.

1 specimen from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

This is another of the "Challenger" species which has been brought to light again by the "Thetis." The series of specimens ranges in diameter of disc from three to ten millimetres, and the arms are six to eight times as long. Lyman[18] places this species in the group in which, he says, "the number of mouth papillæ increases with age." In his original description he says there was only one specimen in the "Challenger" collection, and it is therefore hard to understand upon what evidence he bases the statement. The series of specimens collected by the "Thetis" reveals no such increase. The number of spinelets in the interbrachial spaces varies greatly in different individuals; they are often very numerous, extending well on to the disc, but sometimes they are very few and scarcely to be seen from above. The arms are very flat, noticeably wider at about the twelfth joint than at the base, and then tapering to a long and very attenuate point.

[18] Lyman—"Chall." Report, Zool., v., 14, 1881, p.113.

The upper arm-plates in large individuals are often broken into two or more plates. There are usually five arm-spines, but occasionally six are found on the basal joints.

AMPHIPHOLIS AUSTRALIANA,[19] sp. nov.

(Plate lii, figs. 1-3).

Diameter of disc, 3·4 mm.; length of arm, 8 (?) mm. Disc flat, circular, covered by 100-150 coarse scales, in addition to the conspicuous radial shields, which are half as wide as long, in close contact along their inner margins, and strongly convex on the outer side. Upper arm-plates about as long as wide, squarish or pentagonal, with a wide angle proximally, and corners usually more or less rounded; even at base of arm they are widely separated from each other. Each interbrachial space below, completely covered by about forty-fifty scales. Oral shields rather triangular, with a sharp angle inward and a strongly convex distal margin about as wide as long. Adoral plates large, three times as long as wide, somewhat wider at outer than at inner end. Oral plates very small and indistinct. Oral papillæ three on each side, distal one wider than other two together. Under arm-plates more or less pentagonal; first one about as wide as long, hardly one-fourth as large as second, in contact with it; second and succeeding plates longer than wide, well separated from each other. Side arm-plates large, meeting broadly both above and below, the distal margin somewhat flaring; each plate carries three (at base of arm sometimes four) spines, subequal or middle one shortest; uppermost slender, terete and pointed; middle one thickened at base; lowest like uppermost, but less slender; at base of arm uppermost spine equals or may exceed a joint, but is usually much shorter. Tentacle-scales two, relatively large, the one on side arm-plate noticeably larger than the one on under arm-plate. Colour, pale yellowish or whitish, apparently without light spots on outer ends of radial shields.

Seven specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

It is with no little hesitation that I establish a new species of *Amphipholis* closely allied to the common European and American species, and I have only done so after a careful comparison of a large series of specimens from Norway, Denmark, England and Naples, Algeria, Maine, Newport (R.I.), Cape Frio (Brazil), and Talcahuano (Chili), with these seven from Australia. I fail to find any constant character by which the specimens from Europe

[19] *Australia* + *ana*, implying association.

and Algeria, and those from North America, are to be distinguished from each other, and I believe they should all be united under the specific name *squamata*, Delle Chiaje.[20] The specimens from Cape Frio, Brazil, are labelled *tenera*, Ltk., but I cannot see that they are essentially different from *squamata*, and I am inclined to agree with Koehler,[21] that *tenera* is not entitled to recognition even as a variety. The specimen from Talcahuano, on the other hand, is easily distinguishable, and I think is entitled to specific rank. It is labelled *squamata*, but I propose to call it LÆVIDISCA, sp.nov., because of the smooth, rather indistinct scaling of the disc. The other characters are given in the following key, by which the three species here recognised may be distinguished :—

Disc covered by numerous (150-300) scales ; upper arm-spine more or less flattened ; arm-joints short, about equal to or shorter than spines.	
Disc-scales distinct (when dry) ; outer margins of radial shields decidedly convex ; upper arm-spine narrow, moderately flattened; white spot at outer ends of radial shields..	*squamata.*
Disc-scales indistinct (even when dry), appearing as though a smooth, delicate skin covered the whole disc ; outer margins of narrow radial shields nearly straight ; upper arm-spine wide and very flat, others similar ; no white spot on radial shields.....	*lævidisca.*
Disc covered by 100-150 scales ; upper arm-spine slender, terete ; arm-joints long, commonly exceeding the spines....	*australiana.*

Both Lyman[22] and Koehler[23] report *squamata* from Australia. I find it hard to believe that such eminent authorities on Ophiurans as are these savants should be mistaken, but it is certainly very remarkable if *Amphipholis squamata* occurs, as well as *australiana*, in Australian waters.

OPHIOCNIDA PILOSA.

Ophiocnida pilosa, Lyman, Bull. Mus. Comp. Zoöl., vi., 2, 1879, p. 32.

1 specimen from Station 13. Off Cape Three Points, 41-50 fathoms ; sticky mud and shell.

1 specimen from Station 55. Off Crookhaven River, 11-15 fathoms ; sand to rock.

2 specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

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[20] Leach's *Ophiura elegans* is absolutely unrecognizable.

[21] Koehler—Bull. Sci. France et Belg., xli., 1907, p.305.

[22] Lyman—"Chall." Report, Zool., v., 14, 1881, p. 136.

[23] Koehler—Ophiuroidea : Fauna Sudwest Australiens, i.,3-5, 1907, p.244.

These specimens are all in poor condition, but I think there can be no doubt of their identity with the "Challenger" species from the same region.

OPHIOCOMA BREVIPES.

Ophiocoma brevipes, Peters, Arch. Naturg, xviii., 1, 1852, p.85.

Five specimens from Lord Howe Island.

The single young specimen (disc diameter, 7 mm.) is much lighter coloured than the adults (disc diameter, 25 mm.), and its general appearance is correspondingly different.

OPHIOCOMA SCOLOPENDRINA.

Ophiura scolopendrina, Lamarck, Anim. s. Vert., ii., 1816, p.544.

Ophiocoma scolopendrina, Agassiz, Mém. Soc. Sci. Neuchâtel, i., 1835, p. 192.

Nine specimens from Lord Howe Island.

Only one of these specimens is so uniformly dark as to resemble *erinaceus*, and even in that one the banding of the arm-spines, characteristic of *scolopendrina*, is indicated.

OPHIACANTHA HETEROTYLA,[24] sp. nov.

(Plate lii, figs. 4-6).

Diameter of disc, 3 mm.; length of arm, 6 (?) mm. Disc rather flat, circular, covered by a layer of rather coarse scales, which are, however, completely concealed by a uniform coat of coarse, nearly spherical granules. Radial shields nearly concealed, the distal ends visible, rounded, widely separated; position of proximal part of each shield is indicated by a longitudinal series of spinelets, usually three, rarely two or four; these spinelets are very conspicuous, and seem to be the only spinelets on the disc. Upper arm-plates fan-shaped, with strongly convex distal margin, and sharp, proximal angle about as long as wide, separated from each other from the very first. Interbrachial spaces below like disc above. Oral shields much wider than long, roughly pentagonal, with wide proximal angle. Adoral plates large, quadrilateral, about equally wide at both ends. Oral plates much smaller than adoral. Oral papillæ three on each side, subequal, and a much larger tooth-like one at apex of the jaw. Under arm-plates pentagonal, with a proximal angle, a little wider than

[24] ἕτερος=other, different + τύλη=anything rising like a lump, in reference to the two kinds of grains or spinules on disc.

long, widely separated (even first and second) from each other; first is widest proximally, but others are all widest distally. Side arm-plates large, somewhat flaring, meeting broadly above and below; each plate carries four (on basal joint five) smooth spines, the uppermost much the longest and stoutest; these spines are slender and terete, blunt or somewhat acute, and the uppermost on basal joint (where the two series of opposite sides meet) is as long as two and a half arm-joints. Tentacle-scale single, rather large, flattened, but narrowed and often spiniform. Colour uniform light brown, lightest beneath.

2 specimens from Station 35. Off Port Hacking, 22-38 fathoms; sandy.

10 specimens from Station 55. Off Crookhaven River, 11-15 fathoms; sand to rock.

29 specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

This little species, though such a small member of a large and perplexing genus, is easily recognised by the peculiar arrangement of spinules on the disc. I know of no species with which it can be confused.

OPHIOPRISTIS AXIOLOGUS,[25] sp. nov.

(Plate liii, figs. 1-3).

Diameter of disc, 3 mm.; length of arm, 6 (?) mm. Disc covered by coarse scales, each of which carries one or two short, thorny stumps, which are a little expanded at the top, and bear a crown of three or four very short teeth there. Radial shields are scarcely to be distinguished, though a pair of plates, widely separated, somewhat larger than the disc scales and without stumps, can be seen at the bases of some of the arms. Upper arm-plates triangular, with a sharp proximal angle, widely separated from each other. Interbrachial spaces below covered by stump-bearing scales, similar to those of disc. Oral shield very small, wider than long. Madreporic shield large, and swollen with four conspicuous pores. Adoral plates small, about as wide as long. Oral plates large, but outlines very indistinct. Oral papillæ about eight, of which the distal three or four are remarkably long and sharp, and serve as tentacle-scales on the outer side of the first pore; the jaw ends in one or two infradental papillæ; inner side of first pore guarded by four or five shorter, but sharp, papillæ; these may be so reduced as to be

[25] *ἀξιόλογος*=worthy of mention, remarkable.

hardly visible. Under arm-plates more or less pentagonal; first one much longer than wide, narrowest proximally; succeeding wider than long, distinctly separated from each other. Side arm-plates large, meeting both above and below; each one carries a conspicuous vertical ridge, bearing five or six sharp, rather stout, smooth arm-spines; lowest spine longest, exceeding a joint; uppermost spine shortest, about half as long as lowest. Tentacle-scales long and sharp, very conspicuous; the second pore has three, the third two or three, the fourth two or one, the fifth and all succeeding pores one. Colour, very light brown.

1 specimen from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

This specimen is so small and in such poor condition, I have hesitated to base a new species upon it. But there seems to be no question that it belongs in Verrill's genus *Ophiopristis*, and I do not find any species of that group to which the specimen could possibly be assigned.

OPHIOTHRIX ACESTRA,[26] sp. nov.

(Plate liii, figs. 4-5).

Diameter of disc, 7·5 mm.; length of arm, 24 (?) mm. Disc somewhat puffed in interbrachial areas, but not conspicuously so, covered with erect, slender stumps, which are crowned with three or four (rarely five) long, slender, acute, diverging spinelets; these spinelets are more than half as long as the stump. Many of the stumps, particularly at centre of disc, are prolonged into very slender, needle-like spines, three times as long as the ordinary stumps; these acicular spines are not smooth, but carry at least, near middle and below, three or four irregularly scattered, coarse, sharp teeth. Radial shields broadly tringular, more or less separated by a narrow series of stump-bearing plates, and more or less concealed by the thorny stumps, which are borne to some extent by the radial shields themselves; outer ends of radial shields usually bare and well-defined. Upper arm-plates somewhat keeled, trapezoidal, but overlapping so as to appear pentagonal, with a very short proximal side; two distal sides longer than two proximal; distal angle rounded. Interbrachial spaces below bare, except at centre and margin, where the stump-bearing plates on the disc are continued; when dry, the supplemental genital plates, next to oral shield, and the genital plates themselves, become very conspicuous. Oral shields wider than long,

[26] ἄκεστρα=a darning needle, in reference to the long needle-like spines on disc.

rounded or pointed proximally, and more or less abruptly contracted distally into a sort of handle, which may be half as long as the plate, and is truncate distally, where it joins the supplemental genital plates. Adoral plates large, usually in contact. Tooth-papillæ remarkably long, the length three or four times the thickness. Under arm-plates much wider than long, somewhat octagonal or hexagonal, with proximal side concave. Side arm-plates not very large, not meeting either above or below; each plate carries seven glassy, very thorny arm-spines; basal joints have eight or even nine spines; uppermost or next to uppermost spine longest, equal to about four joints. Tentacle-scale single, small. Colour of disc, very light grey or yellowish; of arms, pale pinkish, with indications of a broad, longitudinal, white stripe, dorsally.

1 specimen from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

2 specimens from Station 52. In Shoalhaven Bight, 19-20 fathoms; sand to mud.

It seems best for the present to consider this an undescribed species, but in view of the great variety of *cæspitosa* I shall not be surprised if it proves to be an extreme variant of that species. The specimen from Station 48 is much more like *cæspitosa* than the other two, and should, perhaps, be referred to that species, but it is in such poor condition that its real relationship is uncertain.

OPHIOTHRIX CÆSPITOSA.

Ophiothrix cæspitosa, Lyman, Bull. Mus. Comp. Zoöl., vi., 2, 1879, p. 53.

4 specimens from Station 10. Off Broken Head, 28 fathoms; fine sand.

1 specimen from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

1 specimen from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

2 specimens from Station 44. Off Coogee, 49-56 fathoms; fine sand.

4 specimens from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

1 specimen from Station 55. Off Crookhaven River, 11-15 fathoms; sand to rock.

These specimens are all small, except three of those from Station 10, and most of them are in very poor condition. I have compared them with a cotype of *cæspitosa* from Port Jack-

son, and I am satisfied that the specimens from Stations 13, 48 and 55 are conspecific, although none of them have the disc so closely covered with stumps, or the radial shields so completely concealed, as in the "Challenger" specimen. The individual from Station 36 is remarkable for having very few stumps and the radial shields conspicuously bare; but it is a very young specimen. The specimens from Station 44 are so small and in such poor condition, their identification is pure guess-work. The specimens from Station 10 are the largest and best preserved of all; the disc bears many slender, acicular spines among the stumps, as in *acestra*, and were it not for two things I should have referred them to that species; the upper arm-plates are like those of *cæspitosa*, not like those of *acestra*, and the arms are prettily banded with pink (or reddish) and blue (or purplish), exactly as in nearly all the specimens of *cæspitosa*, and entirely unlike *acestra*. For the present, it seems to me best to consider these specimens from Station 10, a variety of *cæspitosa*, but we shall never understand their true position until a careful study can be made of an abundance of living and fresh material of *Ophiothrix* at Port Jackson or some neighbouring point.

OPHIOTHRIX SPONGICOLA.

Ophiothrix spongicola, Stimpson, Proc. Acad. Nat. Sci. Phil., vii., 1855, p. 385.

1 specimen from Station 10. Off Broken Head, 28 fathoms; fine sand.

1 specimen from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

1 specimen from Station 54. Within Jervis Bay, 10-11 fathoms; seaweed and sand.

These specimens are identical with three fine specimens from Port Jackson in the collection of the Museum of Comparative Zoölogy, which were received in exchange from the Australian Museum, labelled *O. fumaria*, M. & T. I have compared these specimens with the specimens of *O. fumaria* in the collection of the Museum of Comparative Zoölogy, which Mr. Lyman h marked as having been compared with the original specimens of *fumaria* in Paris, and they are certainly not conspecific. Bell[27] is responsible for the identification of these Port Jackson specimens, as they are undoubtedly the same as those referred by him to *fumaria*. Finding that they were not *fumaria*, I made a more thorough examination of the literature on *Ophiothrix*, and I am

[27] Bell—Zool. Rep. "Alert," 1884, p. 140.

now satisfied that they belong to Stimpson's species, the type of which was from Port Jackson. Unfortunately, Stimpson's originals are no longer extant; they were probably destroyed with so much else of his material in the great Chicago fire. But his description fits these specimens in every particular, except that he gives the colour as "black," and the arms "black and red." This difficulty is, however, a very slight one, for while the real colours appear to be blue and reddish, the blue is usually so deep that it is almost bluish-black, and in life large specimens probably give the impression of black and red. Stimpson's description of the disc, the arms, and the arm-spines fit these Port Jackson specimens so well, it does not seem to me there can be any doubt that we have to do with his species, *spongicola*.

OPHIOMYXA AUSTRALIS.

Ophiomyxa australis, Lütken, Add. ad. Hist. Oph., Pt. 3, 1869, p. 45.

One specimen from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

The specimen is a small one, with a disc diameter of 7 mm., and an arm-length of about 28 mm., but I do not think there is any doubt that it belongs to this species.

ASTROPORPA AUSTRALIENSIS,[28] sp. nov.

(Plate liv, fig. 2.)

Diameter of disc, 11·5 mm.; length of arm, about 68 mm.; thickness of arm at base, 3 mm. Disc made up of five wedge-shaped divisions, each of which corresponds to a pair of radial shields, though no indications of such shields are to be seen; the inner ends of the wedges are united to form a pentagonal area, 6 mm. in diameter, which is covered with rather coarse granules of variable size and very irregular arrangement. Upper surface and sides of arms completely covered with alternating half-circles of hook-bearing granules, and of smooth granules; the former are colourless or whitish, and there are four or five series in each half-circle, while the smooth granules are brown, in marked contrast, and there are only two or three series in each half-circle. These alternating half-circles continue on to the disc, forming curved ridges across each radiating wedge, the innermost ridge of hook-bearing granules forming the outer boundary of the disc-pentagon alluded to above. There is thus no evident line of division between disc and arms. Entire oral surface, even to tip of arms,

[28] *Australia* + *ensis*, expressing locality.

covered with a fine, granular pavement. Each jaw carries about a dozen more or less spiniform oral papillæ and teeth. Genital slits minute. First pair of arm-pores without tentacle-scales, but all subsequent pores are guarded by a series of four to seven, very small, peg-like tentacle-scales (arm-spines), of nearly equal size. Colour, very light brown or dirty whitish, prettily annulated from tip of arm to centre of disc with bright brown; lower surface of arms brown.

One specimen from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

The occurrence of a species of *Astroporpa* in Australian waters may be considered one of the noteworthy discoveries made by the "Thetis," for the two species previously known are exclusively West Indian. The Australian species resembles *A. annulata*, Orst. and Ltk., very closely, but is easily distinguished by the fact that the half-circles of hook-bearing granules are broader and more flattened and carry less conspicuous granules and hooks, particularly at base of arms; thus, in *annulata* there are only two or three series of granules in each half-circle and at base of arm there is usually only a single, conspicuous series, while in *australiensis* there are four or five such series. The colouration of the two species is remarkably similar.

ASTROTHROMBUS,[29] gen. nov.

Disc covered by a very irregular, rough pavement of granules and plates of very diverse sizes, among which one fails to find any definite indications of radial shields, though the largest plates are at the bases of the arms, and may even be arranged in a more or less noticeable pair. The arms are simple, capable of coiling vertically, with the side arm-plates continued upwards in double lines of close-set nodules, homologous with upper arm-plates, and bearing minute hooks. Tentacle-scales, several, short and rough at tip. Jaw with a very few sharp teeth or papillæ at apex. Two genital openings in each interbrachial space.

Type-species, the following.

ASTROTHROMBUS RUGOSUS,[30] sp. nov.

(Plate liv, fig. 3.)

Diameter of disc, 7 mm.; length of arm, 30 (?) mm. Disc covered with a very irregular pavement of granules of diverse

[29] *ἄστρον*=a star + *θρόμβος*=a lump, symphonious with its generic allies, and in reference to the rough disc.

[30] *rugosus*=rough, in reference to the irregular covering of the disc.

sizes and forms; the large ones are rounded, but some of the small ones are quite angular. The largest are at the bases of the arms, but no radial shields are visible, and it is probable that the large pair of plates shown at the base of one arm in the figure given, are really bare spots from which the granules have been rubbed off. Upper surface and sides of arms completely covered with half-circles of hook-bearing granules, alternating with much coarser, smooth granules; there are two or three series of granules in each half-circle; the smooth ones are much larger than those bearing hooks. Oral surface of disc and arms covered with a rough pavement of small granules. Each jaw carries at apex several sharp, flattened, tooth-like papillæ.

Genital slits minute. First pair of arm-pores without tentacle-scales, but all subsequent pores with two (three?) small, peg-like tentacle-scales, rough at the tip. Colour, uniformly light brown.

1 specimen from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

Although this species is obviously nearly related to the preceding, it does not seem possible to place it in the same genus, the character of the disc is so different. It seems to be necessary, therefore, to institute a new genus for its reception.

CONOCLADUS AMBLYCONUS,[31] sp. nov.

(Plate lv.)

Diameter of disc, 15 mm.; length of arm, about 50 mm.; width of arm at base, 7 mm.; height of arm at base, 3·5 mm. Disc wholly made up of five wedge-shaped divisions, each composed of a pair of radial shields; no distinct line of division between disc and arm. Each wedge-shaped area carries eight—ten large, rounded tubercles, 1—2 mm. in diameter and rather less than that in height; the largest ones are crowded at centre of disc; among these tubercles are scattered twenty-five—thirty more or less circular, bare plates, the spaces between which are filled by minute rounded granules. Arms dichotomously branched four or five times, the basal, undivided portion about equalling diameter of disc; upper surface and sides of arms covered by tubercles, plates and granules like those of the disc; there are about four series of the large tubercles on basal portion, two above and one on each side; the latter series hardly extend beyond the first fork, but the upper ones may be traced at least to the third fork, and usually beyond. Lower surface of disc and arms covered

[31] ἀμβλύς = blunt + κῶνος = a cone, in reference to the blunt, conical tubercles on the disc and arms.

with a close pavement of flattened granules, largest in the interradial areas. Apex of jaws with a group of flattened, slender, pointed, but hardly spiniform teeth; sides of jaw with four or five similar, but smaller oral papillæ. One large madrepore plate. Genital slits short but conspicuous. Oral tentacle-pores inconspicuous; next pair conspicuous and without tentacle-scales; succeeding pores are protected by four or five short, thick, tentacle-scales (arm-spines?), of which the inner are much the largest. Smallest branches of arms show the usual arrangement in the Astrophytidæ, of alternating rings of minute hooks, and of granules. Colour, uniform reddish-brown. Other specimens are much paler, and some are nearly white.

1 specimen from Station 12. Off Cape Three Points, 23-34 fathoms; sand.

6 specimens from Station 44. Off Coogee, 49-50 fathoms; fine sand.

1 specimen from Station 49. Off Port Kembla, 63-75 fathoms; mud and pebbles.

1 specimen from Station 53. Off Crookhaven River, 23 fathoms; rock.

6 specimens from Station 54. Within Jervis Bay, 10-11 fathoms; seaweed and sand.

1 specimen from Station 55. Off Crookhaven River, 11-15 fathoms; sand to rock.

3 specimens from Station (?)

The largest of these specimens has the disc nearly 50 mm. in diameter, the tubercles are more numerous than in the type and are very rough, the arms branch seven times, and there are six tentacle-scales at the base of the arm; in other respects it resembles the type very closely. The smallest specimen has the disc only 3 mm. in diameter, and the arms branch only once or twice; there is a single large tubercle on the disc, at the base of each arm. The differences between this species and the following in the form and arrangement of the tubercles seem to be very constant, and it is an easy matter to separate specimens of the two when they have been mixed. If one may judge from the "Thetis" collection, this species seems to be decidedly the more common.

CONOCLADUS OXYCONUS.

Conocladus oxyconus, H. L. Clark, Bull. Mus. Comp. Zoöl., lii., 1909, p. 132.

One specimen from Station 10. Off Broken Head, 28 fathoms; fine sand.

One specimen from Station 44. Off Coogee, 49-50 fathoms ; fine sand.

One specimen from Station (?)

The largest of these specimens has the disc about 25 mm. in diameter ; the colour is dirty whitish, prettily but irregularly spotted with purplish-brown. This specimen raised the question in my mind whether it were not really conspecific with Verrill's[32] *Astrophyton australe*. Although smaller than Verrill's type, and with different proportions and colouration, in some respects it answers well to his description; the conspicuous wedges of which the disc is made up, and to which Verrill makes no reference, and the apparent absence of radial shields and interradial areas, to both of which Verrill refers, made it seem impossible, however, that the two could be identical. Thanks to the kindness of Mr. Henry V. Pelton, who has sent me from Poughkeepsie, one of Verrill's originals, I have been able to settle the question in the negative ; though nearly related, the two are not even congeneric. Verrill's species seems to be a true *Gorgonocephalus*, with distinct radial shields, well separated from each other, and well-marked interradial areas. The tubercles on the arms are very much smaller than those on the radial shields, and the line of separation between the disc and arms is obvious. In spite of these differences, however, no one who compares the specimens will question that *Conocladus* has been derived from an ancestral form, strikingly like *Gorgonocephalus australe*.

ECHINOIDEA.

Although the 243 Echini in the collection represent fifteen species, the great bulk of the collection, 174 specimens, belongs to only two. One of these two, however, proves to be a most interesting new species of *Fibularia*, remarkable for the brooding of the young by the female, and the consequent striking difference between the sexes. Of the other thirteen species, one appears to be a new species of *Chætodiadema*, a genus first established in 1900, but of which this is the third species discovered since the type-species was described. There are a number of specimens of an *Echinocyamus*, first collected by the "Siboga," and a dozen of the recently-described *Asthenosoma thetidis*, H.L.C. A single beautiful specimen of *Stephanocidaris bispinosa*, Lamk., is one of the great prizes of the collection. The remaining ten species are all well known, and all have been previously recorded from Australia. It is remarkable that there is no Spatangoid in the collection, except a single specimen of *Breynia* from Lord Howe Island.

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[32] Verrill—Bull. U.S. Nat. Mus., No. 3, 1876, p. 74.

PHYLLACANTHUS IMPERIALIS.

Cidarites imperialis, Lamarck, Anim. s. Vert., iii., 1816, p. 54.
Phyllacanthus imperialis, Brandt, Prodrome, 1835, p. 268.

One specimen from Station 54. Within Jervis Bay, 10-11 fathoms; seaweed and sand.

This specimen has the test 62 mm. in diameter, and there are 7 coronal plates in each column. The largest primary spines are 54 mm. long and 6 mm. in diameter. The neck of the primaries is purplish and shining, while the collar is fawn-colour and minutely roughed. The secondary and miliary spines are bright brown, becoming reddish at the tips. The abactinal system is ·31, and the actinal system is ·40, of the horizontal diameter of the test.

STEPHANOCIDARIS BISPINOSA.

(Plate liv, fig. 1.)

Cidarites bispinosa, Lamarck, Anim. s. Vert., iii., 1816, p. 57.
Stephanocidaris bispinosa, A. Agassiz, Rev. Ech., Pt. 1, 1872, p. 160.

One specimen from Station 17. Off Broughton Island, 29-48 fathoms; sand and shell to rock.

It is impossible not to be enthusiastic over the superb specimen of this lovely species, one of the handsomest of the Cidaridæ, which the "Thetis" has been so fortunate as to collect. The horizontal diameter is 45 mm.; the vertical diameter is 25 mm. (·55 h.d.); the abactinal system measures 21·5 mm. across (·48 h.d.); and the actinal system, 18 mm. (·40 h.d.). There are seven coronal plates. The longest primary is 60 mm. (1·33 h.d.). There are *no large globiferous pedicellariæ* whatever, but tridentate (similar to those of *S. hawaiensis*) are fairly common; the specimen is in such perfect condition that there is no possibility that the large globiferous pedicellariæ have fallen off since it was taken. The interambulacral secondary spines are greenish with a dark longitudinal stripe, and pinkish tips. The primary spines are more or less green and purplish; collar conspicuously spotted with pure white. The actinal primaries have the conspicuous cap characteristic of the genus, and the abactinal system is also like that of the original specimen, on which the genus was based. This specimen confirms my previously expressed opinion[33] that neither Mortensen nor Döderlein has seen a specimen of *bispinosa*, and it must therefore be very rare. It

[33] Clark—Bull. Mus. Comp. Zoöl., li., 7, 1907, p. 194.

is particularly interesting to find that this perfect specimen from Australia agrees with the specimen in poor condition in the collection of the Museum of Comparative Zoölogy, and with all the specimens of its near ally, *S. hawaiiensis*, in the absence of large globiferous pedicellariæ; whereas the East Indian *S. glandulosus* has such pedicellariæ present in abundance.

GONIOCIDARIS TUBARIA.

Cidarites tubaria, Lamarck, Anim. s. Vert., iii., 1816, p. 57.

Gonoicidaris tubaria, Lütken, Bid. Kund. Ech., 1864, p. 137.

1 specimen from Station 10. Off Broken Head, 28 fathoms; fine sand.

9 specimens from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

1 specimen from Station 41. Off Wata Mooli, 52-71 fathoms; soft mud.

4 specimens from Station 48. Off Wollongong, 55-56 fathoms; sand and mud to rock.

1 specimen from Station 54. Within Jervis Bay, 10-11 fathoms; seaweed and sand.

1 specimen from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

3 specimens from Barrenjoey.

15 specimens collected 23 Feb., 1898, but no locality given.

52 specimens with no label or an illegible one.

It is rather remarkable that in all this material of *Goniocidaris* from so many localities, there is not a single specimen of *geranioides*, but all are typical *tubaria*. In my revision of the Cidaridæ[34] I failed to refer to the excellent coloured figures of this species given by McCoy on Plate 100 of his "Prodromus of the Zoology of Victoria," published in 1885. The omission is the more regrettable, as I virtually state (p. 182) that *tubaria* had never been figured previous to the appearance of my paper.

CENTROSTEPHANUS RODGERSII.

Trichodiadema Rodgersii, A. Agassiz, Proc. Acad. Nat. Sci. Phil., 1863, p. 354.

Centrostephanus Rodgersii, A. Agassiz, Rev. Ech., Pt. 1, 1872, p. 98.

One specimen from Lord Howe Island.

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[34] Clark—Bull. Mus. Comp. Zool., li., 7, 1907.

Though completely crushed and otherwise in bad condition, there is no doubt as to the identity of this specimen. According to Etheridge,[35] who gives an interesting account of its habitat and habits, it is fairly common on Lord Howe Island, but is not abundant.

CHÆTODIADEMA TUBERCULATUM,[36] sp. nov.

(Plates lvi. and lvii.)

Test strongly flattened; vertical diameter (15 mm.) only about ·27 of horizontal (55 mm.); coronal plates about 16, uppermost four without primary tubercles; next two, each with one near outer end; those just above ambitus with two or three; those at ambitus and just below with three or four; remaining actinal interambulacral plates with very small primary tubercles or none; above ambitus, secondary tubercles of interambulacra few, scattered and confined almost wholly to outer end of plates; becoming more numerous and more generally distributed at ambitus, they increase rapidly actinally and completely cover the surface of the lowermost coronal plates; miliary tubercles fairly abundant on actinal surface, but comparatively infrequent abactinally. Ambulacral areas rather narrow (9 mm.), about one-third as wide as interambulacra (28 mm.); uppermost two or three ambulacral plates without primary tubercles, but all others above and at midzone carry one each; below midzone only secondary and miliary tubercles are present, but these completely cover the surface of the plates. Pairs of pores in distinct arcs of three at and above midzone, but below midzone apparently only two pairs, or even a single pair, to each plate, and these are widely separated, and form a straight series; from actinostome to ambitus there are about twenty pairs of pores on each side of each ambulacrum. Primary tubercles of both ambulacra and interambulacra perforate and decidedly crenulate. Abactinal system 19·5 mm. in diameter (·35 h.d.), with all the oculars broadly insert. Genital and ocular plates each with three or four secondary tubercles. Centre of periproct occupied by anal tube and a surrounding zone of very minute plates, outside of which is a zone of plates 1—3 mm. in diameter, each carrying a secondary or miliary tubercle. Actinostome very small, 10 mm. in diameter (·18 h.d.), with very distinct but rather wide actinal cuts; buccal membrane sparsely covered by minute plates, some

[35] Etheridge—Austr. Mus. Mem., ii., 1, No. 1, 1889, p. 37.

[36] *tuberculum*=a tubercle+*atus*=possessing, in reference to the actinal surface having distinct tubercles, instead of being closely granulated as in *C. granulatum*, Mortensen.

of which carry pedicellariæ; five pairs of rather small buccal plates. Teeth strongly notched on each side of sharp tip. Primary spines all broken, slender, hollow, finely ridged longitudinally and covered with crowded whorls of minute teeth. Secondary spines very slender, acicular. Pedicellariæ of two kinds, triphyllous and tridentate; former rather scarce, very small, heads only about ·23 mm. in length, ends of valves truncate, sides nearly parallel; tridentate common on all parts of test, except bare abactinal interambulacral spaces, very variable in size, heads ranging from 20 to 50 mm. in length (one much larger (Pl. lvii., fig. 8) but not fully developed was found); neck about as long as head; valves slightly curved, widened and distinctly hooked at tip; apophysis rounded, rather conspicuous; one example of what Mortensen calls a claviform pedicellaria was found (Pl. lvii., fig. 2), but it had no valves, and it seems to me doubtful whether it is a pedicellaria at all. Colour of specimen dried from alcohol, test abactinally, purplish-brown; tubercles, greenish-yellow; a similar tint on outer part of interambulacral plates; a deep blue line, over a millimetre wide, runs on abactinal surface from second interambulacral plate to ambitus, along midline of each column of interambulacral plate. Primary spines greenish or lavender. Actinally, both test and spines are very light brown.

1 specimen from Station 41. Off Wata Mooli, 52-71 fathoms; soft mud.

1 specimen from Station 58 (?). Off Wata Mooli, 28-42 fathoms; fine sand to mud.

The discovery of a *Chætodiadema* off the Coast of New South Wales extends the range of the genus far to the southward. The type-species (*granulatum*) was originally described from the Gulf of Siam, and has been taken also at various stations in the East Indies as far south as New Guinea and at the Maldive Islands; the second species (*japonicum*) is known only from Japan; and the third (*pallidum*) only from the Hawaiian Islands. The Australian species is nearest *japonicum*, having the same conspicuous abactinal blue stripes as that species; it differs from it, however, in the general coloration, in the arrangement of the tubercles, and in the tridentate pedicellariæ; the latter are much like those of *granulatum*.

ASTHENOSOMA THETIDIS.

Asthenosoma thetidis, H. L. Clark, Bull. Mus. Comp. Zoöl., lii., 1909, p. 134.

Twelve specimens from Station 56. Off Botany Bay, 79-80 fathoms; sand and stones.

This is an excellent series of this interesting species, but I have nothing to add to the original description. Perhaps it ought to be repeated here that this is the species referred to by Mr. Edgar R. Waite[37] in his general account of the "Thetis" work, as "*Phormosoma hoplacantha*"; he states that between "two and three hundred examples" were taken "in eighty fathoms off Botany Bay." His further statements deserve quotation:—

"When first removed from the water, these Echinoderms presented a globular form and heaved with a panting or pulsating action. Water oozed from them till they became quite flat; if one of globular form was pricked with a knife the fluid ran out, the larger examples supplying quite a pint. We placed a number of these Echinoderms in a large tin, stacking them to the height of about two feet; in a short time they had shrunk down to a layer of not more than six inches in depth, and were covered by the water which exuded from them. We found wounds from their spines to be very painful."

ECHINOMETRA MATHÆI.

Echinus mathæi, de Blainville, Dict. Sci. Nat., xxxvii., 1825, p. 94.

Echinometra mathæi, de Blainville, Dict. Sci. Nat., lx., 1830, p. 206.

Seven specimens from Lord Howe Island, where this species is said to be the commonest sea-urchin.

STRONGYLOCENTROTUS TUBERCULATUS.

Echinus tuberculatus, Lamarck, Anim. s. Vert., iii., 1816, p. 50.

Strongylocentrotus tuberculatus, Brandt, Prodrome, 1835, p. 64.

Three specimens from Lord Howe Island, where it is said to be common.

HOLOPNEUSTES INFLATUS?

Amblypneustes inflatus, A. Agassiz, Bull. Mus. Comp. Zoöl., iii., 1872, p. 56.

Holopneustes inflatus, A. Agassiz, Rev. Ech., Pt. 1, 1872, p. 136.

One specimen from Station 50. In Shoalhaven Bight, 15-18 fathoms; sand.

The specimen is so small (18 mm. in diameter) that its specific identification is open to some doubt.

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[37] Waite—Austr. Mus. Mem., iv., 1899, p. 18.

TRIPNEUSTES GRATILLA.

Echinus gratilla, Linné, Sys. Nat., 10th ed., 1758, p. 664.

Tripneustes gratilla, Lovén, Ech. desc. by Linn., 1887, p. 77.

Two specimens from Lord Howe Island. The larger is 130 mm. in diameter.

ECHINOCYAMUS PROVECTUS.

Echinocyamus provectus, de Meijere, Tijdschr. Ned. Dierk. Vereen., (2) viii., 1903, p. 6.

17 specimens from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

6 specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

These specimens range from 1·5 to 8 mm. in long diameter. The larger ones agree in every detail of both internal and external anatomy with de Meijere's description, except that there are rarely more than six pairs of pores on a side in the petals, and usually there are fewer. The smallest specimens can scarcely be distinguished from the males of the next species.

FIBULARIA NUTRIENS,[38] sp. nov.

(Plate lviii, figs. 1-11.)

Test ellipsoidal (female) or ovoid (male) in outline, dec dedly flattened, distinctly gibbous actinally and posteriorly, somewhat elevated abactinally and anteriorly in the female. Petals wanting; with a magnification of seventy diameters it is possible to detect ambulacral pores. Genital pores conspicuous (especially in the female), excepting in the posterior interambulacrum, where there is none. Ocular pores apparently wanting. A single large madreporic pore can be plainly seen. Actinostome circular, or nearly so, little sunken, *posterior* to centre of abactinal surface, bare; teeth rather prominent, the posterior one much the largest. Anal system much wider than long, situated half-way between actinostome and posterior margin. In the female, a large part of the abactinal surface is deeply depressed to form a brood-pouch, into which the four large genital pores open, while the posterior interambulacrum, with the madreporic pore at its tip, projects anteriorly in such a way as to make the brood-pouch horse-shoe shaped, with the opening posterior. In the male, the

[38] *nutriens*=nursing, in reference to the caring for the young by the mother.

only indication of the pouch is a very slight depression of the upper ends of the five ambulacra. The dimensions of the female are as follows:—length, 3·3 mm.; width, 2·4 mm.; height of test, 1·7 mm.; distance of anterior edge of actinostome from anterior end of test, 1·5 mm.; diameter of actinostome, ·8 mm. Males are a trifle smaller. Pedicellariæ of two kinds, tridentate and ophicephalous; former very infrequent, the valves (Plate lviii., fig. 3) with remarkably wide bases and expanded, coarsely dentate tips; ophicephalous pedicellariæ (Plate lviii, figs. 1 and 2) with enormously enlarged loops and powerful dentate jaws. Spines with somewhat flaring tips (Plate lviii., fig. 4), made up of eight pointed rods. Colour, very pale brown.

85 specimens from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

2 specimens from Station 57. Off Wata Mooli, 54-59 fathoms; all mud.

Among the novelties taken by the "Thetis," none is more interesting than this remarkable little Echinoid, the only Clypeastroid known in which the test of the female is profoundly modified for the purpose of caring for the young. On account of the complete absence of petals I was at first inclined to establish a new genus for this peculiar species, but as the species of *Fibularia* and *Echinocyamus* have the petals more or less reduced, it has seemed that this character can hardly be used for a generic difference. In its internal anatomy (Plate lviii., figs. 10 and 11) this species is a typical *Fibularia*, but reveals certain peculiarities of its own. The posterior position of the mouth, the short intestine, and the powerful jaws, forming a lantern which is bilaterally symmetrical but radially most asymmetrical, are all noteworthy features. Only two of the females actually had young in the brood-pouch; in each case there were two young ones present. These young were nearly spherical, and measured about ·5 mm. in diameter. It is worthy of remark that this species was found on muddy, rather than sandy, bottom, in company with *Echinocyamus* and seven other Echinoderms.

ECHINANTHUS TESTUDINARIUS.

Echinanthus testudinarius, Gray, Proc. Zool. Soc. 1851, p. 35.

1 specimen from Station 36. Off Botany Bay, 20-23 fathoms; sand to rock.

5 specimens from Station 41. Off Wata Mooli, 52-71 fathoms; soft mud.

7 specimens from Station (?)

One of these specimens is of particular interest because it affords a remarkable illustration of the resorption of an animal's tissue by another animal. A barnacle (acorn shell) attached to the upper side of the test has resorbed an area 16 mm. across, and practically through the test, so that the base of the barnacle is completely sunken below the surrounding surface. There is every indication that both the *Echinanthus* and the barnacle were living when dredged.

LAGANUM PERONII.

Laganum Peronii, Agassiz, Mon. Scut., 1841, p. 123.

1 specimen from Station 44. Off Coogee, 49-50 fathoms; fine sand.

1 specimen from Station (?) A dead and bare test.

These specimens are about 20 mm. long. They show no peculiar features.

BREYNIA AUSTRALASIÆ.

Spatangus australasiæ, Leach, Zool. Misc., ii., 1815, p. 68.

Breynia, australasiæ, Gray, Ann. Mag. Nat. Hist., (2), vii., 1851, p. 131.

One specimen from Lord Howe Island, where it is said to occur "in great abundance in the sandy bottom of the lagoon."

HOLOTHURIOIDEA.

The collection of Holothurians is so small and the specimens are as a rule in such poor condition that it is of far less interest than any one of the other classes. The only notable fact is the occurrence of two species of *Molpadia* at the same station, three specimens of each, and both new to science. In view of my recent critical revision of the genus,[39] in which I have refused to recognize as valid a considerable number of species described by other workers, I feel that I lay myself open to criticism in so quickly describing two new species. I can only plead inability to find any known species to which they could possibly be referred; each appears to be remarkably well-characterised.

HOLOTHURIA DIFFICILIS.

Holothuria difficilis, Semper, Holothurien, iii., 1868, p. 92.

Two specimens from Lord Howe Island.

The larger of the two specimens has only eighteen tentacles, while the condition of the smaller prevented its number from

[39] Clark—Apodons Holothurians, 1908, pp. 156-172.

being ascertained. As the Cuvier's organs are well-developed, in spite of the small size (50-75 mm.), it is probable that this is the species of which Mr. Etheridge[40] writes, "The smallest and commonest of the four, a *Holothuria*, of a brownish colour, emits, when touched, a white, sticky, fibrous discharge, which congeals like india-rubber."

HOLOTHURIA FUSCO-CINEREA.

Holothuria fusco-cinerea, Jäger, De Holothuriis, 1833, p. 22.

Four specimens from Lord Howe Island.

These specimens are all small (40-50 mm. long) and are probably the young of this widely distributed Indo-Pacific species. I believe the species referred to by Etheridge[41] as "a large form, a foot in length, perhaps *Holothuria vagabunda*, Selenka, of a blackish-brown colour," is probably the adult form of which these specimens are the young.

HOLOTHURIA MACLEARI.

Holothuria macleari, Bell, Zool. Rep. "Alert," 1884, p. 152.

One specimen from Lord Howe Island.

Although this specimen is more than twice as large as Bell's type-specimen (115 mm. as against 49 mm.), I believe the peculiar coloration (brown, with pedicels and papillæ whitish, in striking contrast) and the similarity in the spicules, warrant calling this specimen *macleari*. It has only nineteen tentacles, one stone canal, and one long, polian vesicle. I infer from the colour that this is the species of which Etheridge[41] says, "A third and rather common Holothurid, brown, mottled with white, we believe to be *Sticophus chloronotus*, Brandt"; so far as I know, *Stichopus chloronotus*, Brandt, is always olive-brown or olive-green, without white marks of any sort. It is, however, quite possible that the species may occur at Lord Howe Island, and that it may there be mottled with white. Colour is, as a rule, an unreliable specific character among the Holothurians.

CUCUMARIA MIRABILIS.

Cucumaria mirabilis, Theél, Chall. Rep. Zool., xiv., Holoth., Pt. 2, 1886, p. 61.

Two specimens from Station 13, Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

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[40] Etheridge—Austr. Mus. Mem., ii., 1, No. 1, 1889, p. 32.

[41] Etheridge—*Loc. cit.*, p. 39.

COLOCHIRUS AUSTRALIS.

Colochirus australis, Luding, Arb. Zool. Inst. Würzburg, ii, 1874, p. 88.

Two specimens from Station 13. Off Cape Three Points, 41-50 fathoms; sticky mud and shell.

Although both specimens are very young, there seems no doubt that they belong to this species.

COLOCHIRUS SPINOSUS.

Holothuria spinosa, Quoy and Gaimard, Voy. de l'Astrolabe, iv., 1833, p. 118.

Colochirus spinosus, Selenka, Zeit. f. Wiss. Zool., xviii., 1867, p. 117.

One specimen from Station 10. Off Broken Head, 28 fathoms; fine sand.

Although the specimen is obviously young, it agrees not only with the description and figures of Quoy and Gaimard, but with specimens of this species from Port Jackson. I have also compared it with a specimen of *Stereoderma validum*, Bell, received from Professor Bell himself, and I am entirely at a loss to see how that species is to be distinguished from *spinosus*. Bell[42] says, "Mr. Ramsay tells me that the naturalists of Sydney have been in the habit of regarding *S. validum* as the *Holothuria spinosa* of Quoy and Gaimard: this determination cannot, I think, be accepted." After a comparison of Bell's specimen, and other similar ones from Port Jackson, with the description and figures of Quoy and Gaimard, I find myself forced to side with "the naturalists of Sydney," especially as Bell does not point out a single character by which his species is to be distinguished from the earlier one.

MOLPADIA DISSIMILIS,[43] sp.nov.

(Plate lviii, figs. 12-21.)

Body moderately stout, 70 mm. long by about 30 in diameter; both oral disc and caudal appendage so contracted no measurements could be made, nor could the number of tentacles be determined. In another specimen the total length is 45 mm.; diameter, 15 mm.; caudal appendage, 4 mm. long; diameter of

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[42] Bell—Zool. Rep. "Alert," 1884, p. 151.

[43] *dissimilis*=unlike, in reference to its distinctness from the following species taken at the same Station.

oral disc, 5 mm.; number of tentacles, 15 ; tentacle a little over a millimeter long, with a minute digit on each side, close to the blunt, rounded tip. No evident genital papilla. Calcareous ring moderately stout; radial projections rather wide, not deeply notched. Polian vessel, stone-canal and respiratory trees could not be discovered in the mud with which the body-cavity was largely filled. Calcareous deposits in body-wall abundant, making the surface very rough to the touch ; these deposits are well-formed tables with a high, rough, more or less pointed spire ; small ones (Pl. lviii, figs. 12, 13) have the disc more or less triangular, perforated by about six holes, the spire made up of three rods with three or four cross-bars ; larger tables (Pl. lviii, figs. 14-16) have the disc more or less round, with ten or twelve holes, the spire with six-eight cross-bars ; height of spire commonly greater than diameter of disc, which may be as much as ·2 mm ; in caudal appendage, tables (Pl. lviii, figs. 17-21) smaller, with numerous (20-40) minute holes in disc, and a low squarish spire, with one or no cross-bar, and coarse teeth at the top. Many tables in the body are in process of transformation into phosphatic deposits ; the latter are comparatively few in the small specimen, but are exceedingly numerous in the type, forming patches often a millimeter across. Oral disc and caudal appendage very light grey ; in the small specimen the tentacles are yellowish, the body light yellowish-grey, with scattered spots of yellowish-red ; in the type the phosphatic bodies are so numerous, the general colour is brick-red, finely speckled with grey.

Three specimens from Station 46. Off Jibbon, 50-66 fathoms ; mud and abattoir refuse.

The affinities of this interesting Holothurian will be discussed in connection with the following species.

MOLPADIA PRODUCTAMENSIS,[44] sp.nov.

(Plate lviii, figs. 22-30.)

Body quite stout, 68 mm. long by 35 in diameter ; oral disc, 5 mm. in diameter ; caudal appendage, 6 mm. long. Tentacles so contracted neither their number nor the position and number of the digits could be determined. No evident genital papilla.

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[44] *productus*=drawn out+*mensis* (ablative plural of *mensa*, table)=with tables, in reference to the drawn out ends of the table in the caudal appendage.

Calcareous ring remarkably wide, with conspicuous anterior projections and posterior radial prolongations; entire length of radial piece more than 5 mm.; posterior prolongation, 2 mm., notched for nearly its whole length. Polian vessel, stone-canal, and respiratory trees not observed. Calcareous deposits in body-wall very abundant, making the surface rough to the touch; these deposits are rather stout tables (Pl. lviii, figs. 22-26) with more or less irregular disc (often ·25 mm. in diameter) and high, rough, pointed spire, made up of three rods; disc usually with two or three principal holes, and one or more irregular or incompletely closed ones on or near margin; spire with seven or eight cross-bars; in caudal appendage, tables (Pl. lviii, figs. 27-30) much smaller and more regular, with five—ten perforations in disc, each end of which is drawn out into a short, smooth, blunt rod, and a low triangular spire with only three or four cross-bars. Most of the tables in the body are more or less discoloured, apparently a step towards being transformed into phosphatic bodies, which are excessively numerous, and deeply coloured. Oral disc and caudal appendage very light grey; body almost uniform, deep purplish-red, showing under a lens a fine variegation with light grey lines and dots.

Three specimens from Station 46. Off Jibbon, 50-66 fathoms; mud and abattoir refuse.

It is certainly remarkable that Molpadids were taken only at this one Station, where perhaps the "abattoir refuse" may prove a source of food-supply to these mud-loving and mud-eating animals. But it is even more remarkable that the six specimens taken should be divided equally between two quite distinct species, neither of which has been described hitherto. There appears to be no doubt of their distinctness, for none of the specimens shows the least tendency towards intergrading characters. The difference between the two species in their calcareous rings is almost as striking as the difference in their calcareous deposits. While both species approach the common Pacific species *intermedia* in their general appearance, the calcareous tables are so different from those of that species that they cannot be considered very closely allied to it.

The discovery of these two new species necessitates the modification of the key to the species of *Molpadia*, published early last year[45] and subsequently altered[46] to admit a new species from Japan. The first part of this key will now read as follows:—

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[45]Clark—Apodous Holothurians, 1908, p. 158.

[46]Clark—Bull. Mus. Comp. Zool., li., 1908, p. 311.

A. Anchors wanting, etc.

B. Phosphatic deposits present, etc.

C. No true supporting rods, etc.

D. Tables of body normal or often very irregular, distorted or incomplete, sometimes wholly wanting; disc seldom with more than ten holes (those in tail may have 20-40 holes).

E. Tables with more or less distinct disc, having 2-10 or more (usually 3-6) holes, often with irregular outline and marginal projections; sometimes with no spire, and thus reduced to small irregular plates with 2-10 perforations.

F. Tables or plates of moderate size, 80-350μ in diameter, usually with a single spire.

G. Tables often wanting in skin of body, present in tail; disc quite asymmetrical; spire of moderate height and often with teeth or branches at top... OOLITICA. / CONCOLOR.

GG. Tables (or perforated disc-like plates) present in skin of body; disc rather symmetrical with 3-6 or more holes; spire (when present) high.

H. Phosphatic deposits more than 60μ in diameter; tables with spires; colour not old-rose red.

I. Discs of tables in tail not narrowed and drawn out into a rod at either end.

Discs of tables in tail with 6-12 large and small holes... ..... INTERMEDIA.

Discs of tables in tail with 20-40 small holes..... ..... DISSIMILIS.

II. Discs of tables in tail narrowed and drawn out at each end into more or less of a rod.

Discs of tables in tail with numerous (10-30) holes, the ends flattened and rough or serrate... ANDAMANENSIS.

Disc of tables in tail with few (5-10) holes, the ends rounded and smooth..... ..... PRODUCTAMENSIS.

HH. Phosphatic deposts very minute, 40μ or less in diameter; tables reduced to perforated disc-like plates; colour old-rose red..... ROSEA.

FF. Tables very small, etc.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

PART 12.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

Published July 6th, 1910.

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CRUSTACEA.

PART V.

AMPHIPODA.

By The Rev. THOMAS R. R. STEBBING, M.A., F.R.S., F.L.S., F.Z.S., Hon. Member New Zealand Institute, Fellow of King's College London, Hon. Fellow of Worcester College, Oxford.

NOTICE.

The Plates belonging to Mr. Stebbing's Paper on Amphipoda follow after Plate No. lviii., and are numbered xlvii.* to lx.*

CRUSTACEA.

PART V.

AMPHIPODA.

By The Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S., Hon. Member New Zealand Institute, Fellow of King's College London, Hon. Fellow of Worcester College, Oxford.

The present Report is not concerned with a large number of new species. Of these there are only thirteen. They are distributed among the same number of genera, of which three are new. Incidentally also a new genus, *Parawaldeckia*, is instituted for a species previously called *Nannonyx thomsoni*, from New Zealand, and not as yet recorded in Australian waters. The new genus *Ochlesis* is worthy of note, since by the character of its maxillipeds it forms a link between the Gammaridea and the Hyperiidea. For this reason it appears to justify the institution of a new family, the Ochlesidæ. In all, forty-four species have been identified among the specimens of the "Thetis" collection. In the genera *Eusiroides*, *Eurystheus* and *Icilius*, it is possible that future stringency of specific determination may reduce the number of species here noted. Some reductions in regard to other genera are suggested in the report itself. Thus, the genus *Vijaya*, Walker, 1904, is made a synonym of Haswell's *Amaryllis*, and Walker's *Gallea tecticauda*, of the same date, loses its significant specific name by identification with Haswell's earlier *Cyproidea ornata*.

For the preoccupied *Eurystheus dentatus*, Holmes, *E. alaskensis* is proposed.

Various problems in regard to Australian Amphipoda remain still unsolved, but the two species *Paradexamine flindersi* and *Dryopoides westwoodi*, of which the "Challenger" Expedition obtained a lamentably scanty supply, are now indebted to the "Thetis" specimens for their proper places in classification. Some strange cases of superficial resemblance and actual diversity are afforded by *Iphimedia ambigua*, Haswell, and *Iphimedia discreta*, sp.nov., in one and the same genus, and by *Lætmatophilus hystrix* (Haswell), and *Podocerus hystrix*, sp.nov., in two neighbouring genera. In *Melita fresnelii* (Audouin), *Paraceradocus micramphopus*, sp.nov., and *Ceradocus rubromaculatus* (Stimpson), the striking fretwork of the pleon segments is an ensnaring temptation to mix up species which require to be sorted apart. As noticed under *Eurystheus thomsoni*, the gnathopods

of species otherwise quite distinct seem to have been turned out of the same mould. No doubt the same might be said of less characteristic appendages, but in these it does not attract attention. It is singular that, so soon after Dr. Paul Mayer's institution of a new species of *Dodecas* from Australian waters, a third species from the same locality should now be added to the same small genus.

An attempt is here made to recapitulate all the species of Amphipoda as yet described from Australian and Tasmanian waters. For the tribe or legion of the Gammaridea the order adopted is that followed in my Amphipoda Gammaridea, "Das Tierreich," Lieferung 21, 1906; for that of the Caprellidea, Dr. Paul Mayer's admirable work, "Siboga-Expeditie," Monographie 34, Die Caprellidæ, 1903; and for the Hyperiidea, the "Challenger Reports," vol. xxix., 1888.

The reckoning amounts to one hundred and eighty-two species. A few of these at present are not very clearly established. But that defect will no doubt before long be remedied, and there is good reason to expect that in course of time numerous additions will be made to the inventory here presented.

In forcing specific names into concord with generic terminations I have followed the ruling of "Das Tierreich," though I have long advocated the simpler plan of assuming that all species in zoology are of the masculine gender. The old rule complicates synonymy when a species is moved from one genus to another, and involves the biologist in many needless anxieties. What is he to do, for example, with such a genus as *Cepon*, which is not a neuter word, but the genitive plural of a masculine, being the Greek rendering of the French proper name Desjardins? Even under the rule, as may be seen in this report, an insidious technicality makes it wrong to say *Streetsia porcella*, because the substantive *porcellus* is on a different footing from that of the adjectival *pusillus*. But puerilities have long lives.

AMPHIPODA.

Family LYSIANASSIDÆ.

Lysianassidæ, Buchholz, Zweite Deutsche Nordpolarfahrt, ii., 1874, p. 299.

Lysianassidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 8, 717.

Lysianassidæ, Walker, Nat. Antarct. Exp., iii., 1907, pp. 3, 9.

This family has no competitor in size among the Gammaridea except the Gammaridæ. In "Das Tierreich" forty-nine genera are

defined as belonging to it, and two others are named as still obscure. The Appendix adds *Schisturella*, Norman, 1900; *Lysianopsis*, Holmes, 1903; *Parambasia*, Walker and Scott, 1903; *Paracallisoma*, Chevreux, 1903; *Vijaya*, Walker, 1904; *Socarnella*, Walker, 1904; *Paracyphocaris*, Chevreux, 1905; *Katius*, Chevreux, 1905; *Charcotia*, Chevreux, 1906; *Podoprionides*, Walker, 1906. To these have been added in 1908, *Paralicella*, Chevreux, and *Valettiopsis*, *Lakota*, *Koroga*, and *Aruga*, all instituted by Professor S. J. Holmes. The preoccupied name *Charcotia* was relinquished by Chevreux in 1906 in favour of *Waldeckia*, and in discussing that genus I am here led to propose another, *Parawaldeckia*, for the New Zealand species named *Nannonyx thomsoni*[1]. As *Vijaya* falls out, there are now sixty-four genera provisionally accepted for this family. The boundaries between some of them are not very strongly marked, so that a future revision may lead to the disappearance of a name here and there. Tattersall's *Metacyphocaris* and *Crybelocephalus*, 1906, seem scarcely within the limits.

Mr. A. O. Walker in his Amphipoda of the National Antarctic Expedition[2] remarks that:—"As in the Arctic Amphipoda, the Lysianassidæ greatly preponderate in the number of genera, species and individuals, in one case amounting to tens of thousands of these last on several occasions." The "Thetis" collection, from a very different latitude, offers a rather striking contrast. For though three genera of this family are represented, each afforded only a single species, one indeed, fairly abundant in specimens, but the other two having only three between them.

Genus AMARYLLIS, *Haswell.*

Amaryllis, Haswell, Proc. Linn. Soc. N.S.Wales, iv., 1879, p. 253.

Vijaya, A. O. Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, pp. 231, 241.

Amaryllis, Stebbing, Das Tierreich, xxi., 1906, p. 23.

AMARYLLIS MACROPHTHALMA, *Haswell.*

Stations 28, 35, 37, 44, 57.

Amaryllis macrophthalmus, Haswell, Proc. Linn. Soc. N.S.Wales, iv., 1879, p. 253, pl. viii, fig. 3, a, b, c, d.

Amaryllis brevicornis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 254.

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[1] See p. 571.

[2] Walker—Nat. Antarctic Exp., iii., 1907, p. 1.

Glycerina affinis, Chilton, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 1036, pl. xlvii., fig. 1, a, b.

Amaryllis macrophthalmus, Chilton, Trans. N. Zealand Inst., xxxviii., 1906, p. 267.

Amaryllis macrophthalma, Stebbing, Das Tierreich, xxi., 1906, p. 24.

Amaryllis macrophthalma, A. O. Walker, Trans. Linn. Soc., xii., 1909, part 4, p. 327.

In 1904, Mr. A. O. Walker distinguished a genus *Vijaya* from *Amaryllis* by the character that it has the upper antennæ in the male with the first joint of the flagellum much longer than any of the succeeding joints and very setose. He remarks that "the curious difference in the male and female antennæ makes a new genus necessary." This called my attention to the desirability of examining a male specimen of *Amaryllis macrophthalma*, and the "Thetis" collection has furnished the opportunity. It proves that the difference in question occurs between the sexes of that species, so that the necessity for *Vijaya* is discharged. *Amaryllis tenuipes* (Walker), however, remains specifically distinct, since, unlike any other species of the genus, it has the anterior angle of the fourth side-plate of the peraeon acutely produced forward.

Localities.—Off Manning River; off Port Hacking; Botany Bay, 50 to 52 fathoms; off Coogee; off Wata Mooli, 54 to 59 fathoms. Mr. A. O. Walker notes its occurrence at Wasin, British East Africa, taken at a depth of 10 fathoms. It appears to be an abundant Australian species.

Genus WALDECKIA, *Chevreux*.

Charcotia, Chevreux, Bull. Soc. Zool. Fr., xxx., 1905, p. 163.

Charcotia, Walker, Ann. Mag. Nat. Hist., (7), xvii., 1906, p. 454.

Charcotia, Stebbing, Das Tierreich, xxi., 1906, p. 718.

Waldeckia, Chevreux, Exp. Antarct. Française, Amphip., 1906, p. 13.

Waldeckia, Walker, Nat. Antarct. Exp., iii., 1907, Amphipoda, p. 10.

M. Chevreux, finding that the name *Charcotia* was pre-occupied, adopted in place of it *Waldeckia*, in compliment to Mme. Waldeck-Rousseau, Dr. Jean Charcot's sister. At the same time he distinguished the generic characters from those of the typical species, *W. obesa*, as follows:—

Body extremely obese, integument thick and hard. Side-plates remarkably deep, those of the fifth pair not bilobed.

Antennæ short, sub-equal. Epistome separated from the upper lip by a deep sinus. Mandibles little developed, palp affixed close to the base of the trunk. Outer plate of first maxillæ armed with broad crenulate teeth. Outer plate of maxillipeds much developed, reaching middle of palp's third joint. Hand of first gnathopods not subchelate. Hand of second gnathopods not chelate. All the peraeopods carrying one or two accessory branchial lobes. Rami of third uropods lanceolate, furnished, in the female, with long plumose setæ. Telson deeply cleft.

Characters based on a single female specimen are naturally open to modification. Thus Mr. A. O. Walker has shown that in the male the second antennæ attain a much greater length than the first pair. The integument of the small species obtained by the "Thetis" is not especially hard.

It is not easy to suggest a place for the classification of this genus among the other Lysianassidæ. M. Chevreux himself points out the features which remove it from *Menigrates* and *Lepidepecreum*, to which in some respects it shows proximity. He also gives reasons for not accepting Walker's suggestion of its nearness to *Socarnes*, a suggestion in which I should myself be disposed to concur. Yet Walker puts a stumbling block in the way of this approximation by saying that the inner plate of the first maxillæ has "four or five unequal plumose setæ." Chevreux, on the contrary, figures and describes this plate with only two such setæ, as is the case in the "Thetis" species of this genus and in *Socarnes vahlii* (Kröyer).

There are not many of the Lysianassidæ which have the fourth side-plate of the peræon so strongly produced under the fifth as in *Waldeckia*. One of these is *Kerguelenia*, in many ways an exceptional genus. But the same peculiarity is found in the enigmatical *Ephippiphora kroyeri*, White. Of this species descriptions have been offered by White, Bate, G. M. Thomson, Haswell, and Miers. Unfortunately Thomson and Haswell only quoted Bate, Haswell introducing by a misprint a dorsal *spine* instead of a dorsal *sinus* in the fourth segment of the pleon. It was this sinus, common to a great many of the Amphipoda, which probably suggested to White the pre-occupied generic name *Ephippiphora*—saddle-bearing. An opportunity kindly furnished me by Mr. G. M. Thomson of examining the New Zealand form induced me to call it *Nannonyx thomsoni*[3], but I now think that it should be transferred to a separate genus, which may be named *Parawaldeckia* from its agreement with *Waldeckia* in possessing accessory lobes to the branchial vesicles. In addition to other

[3] Stebbing—Das Tierreich, xxi., 1906, p. 26.

characters to be derived from the specific description, it has a peculiarity in the male second antennæ, the last joint of the peduncle being dilated, and all the preceding joints being very short. There remain for consideration the three species which Haswell originally assigned to *Lysianassa*, under the specific names *nitens*, *affinis*, and *australiensis*, subsequently transferring them along with his *L. kröyeri* to the genus *Anonyx*. In 1882 Haswell spoke of *L. nitens* as allied to *L. kröyeri*, while in 1885 he distinguished *L. australiensis* from the latter species by the non-prehensile character of the first gnathopods, without noticing that those gnathopods are figured by Bate as non-prehensile in the type specimen of *L. kröyeri* (White), a specimen an inch long, from Tasmania. The specimens of *Waldeckia obesa* described by Chevreux and Walker attained a length of 17-18 mm., and the possibility is open that they in fact belong to White's species. Whether any or all of Haswell's apparently much smaller species should be included in the genus *Waldeckia*, and whether the species now to be described should receive one or other of those specific names, are problems insoluble with the information at present available. The differences are not really very considerable between the "Thetis" species and its much larger antarctic companion.

Second joint of third peraeopod attached to side-plate by a narrow neck .. .. 1. *Waldeckia obesa*, Chevreux.
Second joint of third peraeopod broadly expanded proximally as well as distally .... 2. *Waldeckia chevreuxi*, sp.nov.

WALDECKIA CHEVREUXI, *sp.nov.*

(Plate xlvii. B.)

Station 87.

Integument not especially hard. General shape agreeing with *W. obesa*, the fourth side-plate strongly produced under the fifth, which is very large, but having the lower margin decidedly indented, the sixth side-plate much narrower but very deep.

Eyes large, dark, nearly meeting at the top of the head, of which the lateral lobes are rounded. First antennæ with stout first joint, the two following very short, primary flagellum of fifteen short joints. secondary of seven, second antennæ with penultimate joint of peduncle the longest, a little bent at the base, flagellum of seventeen short joints.

The mouth-organs as in *W. obesa*, the palp of the mandibles not shorter than the trunk, as in the figure given by Chevreux contradicting his text. The first maxilla with two setæ on inner

plate, the serrate spines of the outer plate showing great breadth when favourably placed, the broad apex of the palp finely crenulate, with a minute spine at the outer corner. Outer plate of second maxillæ rather the broader. Inner plate of maxillipeds with three minute spine-teeth on the truncate apex, the very broad outer plate finely crenulate, and showing some little spine-teeth in preparation for the next moult, fourth joint of palp more than half length of third, not less than half as in *W. obesa*.

First gnathopods with third joint as long as the fifth, setose on the hind margin, sixth joint without palm, tapering, rather longer than the fifth, finger small, curved. The second gnathopods also agree with those of *W. obesa*, except that the small finger closes over a slightly concave palm, behind which the squamose hind margin is a little obtusely produced. The peraeopods are in general agreement with those of *W. obesa*, except that in the third pair the second joint is broad above as well as below and attached to a bilobed side-plate; and in the last three pairs the fourth joint appears here to be more widely expanded than in the larger species. The marsupial plates are narrow, with long setæ at the extremity. The branchial vesicles, though not well observed, appear to have accessory lobes.

The third uropods have the rami longer than the peduncle, laminar, subequal as to length and breadth, the outer with setæ only on the inner side, not showing any second joint. The telson is divided for more than three-fourths of its length, tapers to the apices, each of which ends in two small spines.

Length, 7·5 mm. from front of head to end of telson.

Locality.—Off Wata Mooli, 54 to 59 fathoms.

Genus TRYPHOSA, *Borck.*

Tryphosa, Borck., Forh. Selsk. Christiania, 1870 (1871), p. 117.
Tryphosa, Stebbing, Das Tierreich, xxi., 1906, pp. 68, 720.

To the nine species of the genus described in "Das Tierreich," the names of four other species were added in the appendix, *T. adarei*, Walker, 1903; *T. murrayi*, Walker, 1903; *T. nugax*, Holmes, 1904; and *T. cucullata*, Walker, 1904. Of these, however, Walker in 1907 cancelled *T. adarei* as being one with *T. murrayi*. But since both in text and plate *T. adarei* has page precedence, it seems clear that the name *T. murrayi* is the one that must be cancelled. More recently the list has been increased by *T. onconotus*, Stebbing,[4] and *T. coeca*, Holmes.[5] With the species now to be described the number will be in all fifteen.

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[4] Stebbing—Ann. S. African Mus., vi., 1908, p. 65, pl. xxxv.
[5] Holmes—Proc. U.S. Nat. Mus., xxiv., 1908, p. 496, figs. 7, 8.

TRYPHOSA CAMELUS, *sp. nov.*

(Plate xlvii. A.)

(Station 57.)

On the fourth pleon segment this little species has a deep dorsal depression leaving the after part as a conspicuous hump, which has suggested the specific name. In many other respects it resembles *T. sarsi*, Bonnier, figured by Sars in the "Crustacea of Norway,"[6] under the subsequently discarded name *Tryphosa nana*, Kröyer. But the postero-lateral angles of the third pleon segment are more sharply out-drawn. In the second antennæ the antepenultimate joint of the peduncle is not shorter but, contrary to custom, longer than the penultimate joint. The mouth organs offer no distinctive characters. The first gnathopods, with their distally narrowed side-plates, are also undistinguishable from those of the allied form. The second gnathopods, however, differ, not having the hinder angle of the hand obtusely quadrate but subacutely produced, though not sufficiently to form a chela with the finger, which is small and weak, not as in the description by Sars, "rather strong." The size of the second joint in the last three peraeopods as compared with the remainder of the limb is greater than in the northern species. In the fifth peraeopods its length considerably exceeds that of the remaining joints combined. Also the fourth joint in these three pairs is more expanded than in the other species. The uropods are not very different from those of *T. sarsi*; the lobes of the deeply divided telson end more acutely and show three spinules instead of two on each lateral margin.

Length of female scarcely more than 3 mm.

Locality.—Off Wata Mooli, 54-59 fathoms.

Family STEGOCEPHALIDÆ.

Stegocephalidæ, Sars, Forh. Selsk. Christiania, No. 18, 1882, p. 23.
Stegocephalidæ, Stebbing, Das Tierreich, xxi., 1906, p. 88.
Stegocephalidæ, Chevreux, Exp. Antarct. Française, Amphip., 1906, p. 22.

Genus ANDANIOTES, *Stebbing.*

Andaniotes, Stebbing, Trans. Linn. Soc., (2), vii., 1897, p. 30.
Andaniotes, Stebbing, Das Tierreich, xxi., 1906, p. 96.
Andaniotes, Chevreux, Exp. Antarct. Française, Amphip., 1906, p. 22.

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[6] Sars—Crust. Norway, i., 2, 1890, p. 27.

Chevreux adds a new species, *A. ingens*, attaining a length of 13 mm., from Port Charcot.

ANDANIOTES CORPULENTUS (*G. M. Thomson*).

Station 57.

Anonyx corpulentus, Thomson, Trans. N. Zealand Inst., xiv., 1882, p. 231, pl. xvii., figs. 1 a-f.
Andania abyssorum, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 739, pl. xxxvii.
Andaniotes corpulentus, Stebbing, Trans. Linn. Soc., (2), vii., 1897, p. 31, pl. viii.
Andaniotes corpulentus, Stebbing, Das Tierreich, xxi., 1906, p. 96.
Andaniotes corpulenta, Chevreux, Exp. Antarct. Française, Amphip., 1906, p. 22.

Of three small specimens taken by the "Thetis" expedition none exceded a length of 3·5 mm. In the specimen dissected the membranaceous second joint of each gnathopod was twisted. In the limb first observed I supposed the condition to be accidental, but it resisted all efforts to straighten it out.

In the "Challenger" Report the palp of the first maxillæ was described as two-jointed, but that was due to a misapprehension. It is no doubt really one-jointed.

It may be added that during the early part of the present year (1909) I recognised this species among the contents of the stomach of *Stauroteuthis hippocrepium*, Hoyle. Dr. Hoyle informs me that this Cephalopod was taken 10th March, 1908, by the "Scotia" Expedition at 24-25 fathoms depth, in Lat. 66° 40′ S., Long. 40° 35′ W. It had also been devouring several species of Isopoda and Copepoda.

Locality.—Off Wata Mooli, from 54 to 59 fathoms depth. Previous captures were from New Zealand waters. Chevreux records females, on an average 6 mm. long, from Port Charcot at depths varying from 20-40 m.

Family AMPELISCIDÆ.

Ampeliscidæ, Sars, Forh. Selsk. Christiania, No. 18, 1882, p. 29.
Ampeliscidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 97, 721.

Genus AMPELISCA, *Kröyer*.

Ampelisca, Kröyer, Naturhist. Tidsskrift, iv., 1842, p. 154.
Ampelisca, Stebbing, Das Tierreich, xxi., 1906, pp. 98, 721.

To the numerous species defined and named under the last reference Professor Holmes in 1908 added *Ampelisca cristata*,

plumosa, *pacifica*, *californica*, *cœca*, *lobata*, and in the same year Mr. Arthur Pearse described *Ampelisca holmesii*.

AMPELISCA PUSILLA, *Sars.*

Station 57.

Ampelisca pusilla, Sars, Crust. Norway, i., 1891, p. 181, pl. lxiii., fig. 2.

It may seem improbable that this little species from the high north should be found in Australian waters, and I was inclined to call the single "Thetis" specimen *pœnepusilla*, but the differences scarcely justify specific separation. There appear to be ocular lenses present, which are wanting in the northern form. In the fifth peraeopods the hind margin has a smoother curve than that shown in either of the figures given by Sars. Each lobe of the telson has a single apical spinule instead of the "two small marginal spinules near the tip," spoken of by Sars.

Locality.—Off Wata Mooli, 54-59 fathoms

Family PHOXOCEPHALIDÆ.

Phoxocephalidæ, Sars, Crust. Norway, i., 1891, p. 142.

Phoxocephalidæ, Norman, Ann. Mag. Nat. Hist., (7), v., 1900, p. 333.

Phoxocephalidæ, Walker, Journ. Linn. Soc., xxviii., 1901, p. 299.

Phoxocephalidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 133, 723.

Phoxocephalidæ, Walker, Nat. Antarctic Exp., iii., 1907, Amphipoda, p. 17.

Phoxocephalidæ, Stebbing, Ann. S. African Mus., vi., 1908, Crust., p. 73.

Phoxocephalidæ, Holmes, Proc. U. S. Nat. Mus., xxxv., 1908, p. 518.

Phoxocephalidæ, Chevreux, Bull. Inst. Océanogr. Monaco, No. 117, p. 8.

Seven genera are defined for this family in "Das Tierreich," and to that number Chevreux, in 1908, added the new genus *Joubinella*. Three of the genera are represented in Australian waters.

Genus PHOXOCEPHALUS, *Stebbing.*

Phoxus, Kröyer, Naturhist. Tidsskrift, iv., 1842, p. 150.

Phoxocephalus, Stebbing, Das Tierreich, xxi., 1906, p. 134.

PHOXOCEPHALUS BASSI, *Stebbing.*

Station 57.

Phoxocephalus bassi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 811, pl. liv.
Phoxocephalus bassi, G. M. Thomson, Ann. Mag. Nat. Hist.,(7), x., 1902. p. 463.
Phoxocephalus bassi, Stebbing, Das Tierreich, 1906, p. 135.

Locality.—A single specimen was obtained by the "Thetis" at Wata Mooli, from a depth between 54 and 59 fathoms.

Family AMPHILOCHIDÆ.

Amphilochidæ, Sars, Forh. Selsk. Christiania, No. 18, 1882, p. 23.
Amphilochidæ, Norman, Ann. Mag. Nat. Hist., (7), vi., 1900, p. 33.
Amphilochidæ, Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 232.
Amphilochidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 148, 723.

To the nine genera of this family distinguished in "Das Tierreich" a tenth genus is here added. Five of the older genera are also represented in Australian waters. The genus *Gallea*, established by Walker in 1904, is clearly identical with Haswell's *Cyproidea*, as restricted.

Genus AMPHILOCHUS, *Bate.*

Amphilochus, Bate, Cat. Amphip. Brit. Mus., 1862, p. 107.
Amphilochus, Norman, Ann. Mag. Nat. Hist., (7), vi., 1900, p. 33.
Amphilochus, Walker, Journ. Linn. Soc., xxviii., 1901, p.300.
Amphilochus, Stebbing, Das Tierreich, xxi, 1906, pp. 149, 723.

Five species of this genus are described in "Das Tierreich," and three others are mentioned as of uncertain classification. In the appendix one of the latter, *A. longimanus*, Chevreux, is definitely assigned to *Amphilochoides*. *Amphilochus spencebatei*, Stebbing, is added to the ascertained species, with *A. anomalus*, Chevreux, 1900, for a synonym.

AMPHILOCHUS MARIONIS, *Stebbing.*

Station 28.

Amphilochus marionis, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 743, pl. xxxviii.
Amphilochus marionis, Stebbing, Das Tierreich, xxi., 1906, pp. 151, 723.

This species is notable for having the telson much shorter than in the other species of the genus except *A. brunneus*, Della Valle. Mr. Walker in 1901 questions whether this, along with his own *A. melanops*, and Della Valle's *A. neapolitanus*, may not be synonymous with *A. marionis*.

Locality.—Off Manning River.

Genus CYPROIDEA, *Haswell.*

Cyproidea, Haswell, Ann. Mag. Nat. Hist., (5), v., 1880, p. 31.

Cyproidia, Chilton, Ann. Mag. Nat. Hist., (7), v., 1900, p. 243.

Gallea, Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, pp. 232, 256.

Cyproidea, Stebbing, Das Tierreich, xxi., 1906, pp. 157, 723.

In 1900 Dr. Chilton added to this genus the species *C. otakensis*, using for the generic name Haswell's alternative spelling *Cyproidia*.

CYPROIDEA ORNATA, *Haswell.*

Station 28.

Cyproidia ornata, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 320, pl. xviii., fig. 1.

Gallea tecticauda, Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 256, pl. iii., fig. 16, pl. viii., fig. 16.

Cyproidea ornata, Stebbing, Das Tierreich, xx., 1906, p. 158.

There can be little or no doubt that Mr. A. O. Walker's *Gallea tecticauda* is identical with the present species. The peculiar characters described by Haswell and found in the "Thetis" specimen, are numerous. They agree with Mr. Walker's description and figures except as regards the gnathopods, the positions of which he has evidently inverted, since his figure of the supposed first gnathopod shows a branchial vesicle, plainly proclaiming that the limb is really not the first gnathopod but the second. These limbs are in fact so closely attached one to the other that their relative position may be easily confused. The specific name *tecticauda* very appropriately referred to the curious "roof-like projection" of the sixth pleon segment over the boat-shaped telson.

Locality.—Off Manning River.

Genus GITANOGEITON, *gen. nov.*

Upper lip deeply incised. Lower lip with cavity on inner margin of principal lobes, as in *Giana* and *Gitanopsis*, mandibular processes obtuse. Mandibles with broad straight cutting edge

divided into numerous denticles; accessory plate only on left mandible, similar to the principal cutting edge, but with the denticles microscopic; spine-row of ten or twelve spines on the surface of the mandibles; molar small, with normal denticulate crown; palp three-jointed, third joint subequal in length to the second, but much narrower than either second or first. First and second maxillæ apparently agreeing with those of *Gitana*; the maxillipeds differing from those of that genus in having the inner plates apically truncate, with two spinules on the inner surface below the apex (as in *Cyproidea ornata*), the outer plate with its inner border strongly emarginate, the outer carrying a single spine which just reaches the apex, the palp with first joint longer than any of the remaining three. First and second gnathopods in female small, subchelate, with fifth joint more strongly produced in the second than in the first pair. Peraeopods slender, except as to broadly expanded second joint in the last three pairs.

The generic name is derived from *Gitana*, a kindred genus, and γείτων, a neighbour. The most distinctive features are the upper lip and the mandibles.

GITANOGEITON SARSI, *sp.nov.*

(Plate lvii. B).

Station 28.

Head with small rostrum. Peraeon rather stout, first side-plates small, the three following large, second widening below, fourth very large, emarginate behind for the bilobed fifth. Eyes of moderate size. Upper antennæ small, first joint nearly as broad as long, second of equal length but narrower, third small but longer than broad; flagellum five (or? seven) jointed; lower antennæ broken, probably not elongate, in peduncle last joint slightly shorter than the penultimate. Whether the palp of the first maxillæ is one-jointed as in *Gitana* or two-jointed as in *Gitanopsis*, could not be decided with absolute certainty. The pellucid inner plate carries a single setule on the broad apex, the outer plate has six prominent spines on its oblique apical border, with perhaps one or two more of insignificant size. The outer plate of the second maxillæ is very narrow, with three short setæ on the apex.

The first gnathopods have the fifth joint wider than that of the second pair, but its hind margin less produced; the sixth joint widens distally to a short oblique palm, which is overlapped by the finger, setulose on its concave margin. In the second gnathopod the sixth joint widens more gradually and has the

palm less oblique. The marsupial plates are very large on this limb and on the first peræopods. The first and second peræopods have the second joint narrow as in the gnathopods, but still more elongate. In the three following pairs this joint is much expanded, with rounded corners, and the hind margin of the fourth joint is a little produced downwards. The appendages of the pleon and telson damaged. Length, about 4·5 mm.

The species is named in honour of Professor G. O. Sars, whose "Crustacea of Norway" is helpful to students of Crustacea, whatever part of the world their collections come from.

Locality.—Off Manning River. A single specimen, female.

Family LEUCOTHOIDÆ.

Leucothoidæ, Sars, Forh. Selsk. Christiania, No. 18, 1882, p. 27.
Leucothoidæ, Stebbing, Das Tierreich, xxi., 1906, p. 161.

In 1907 Mr. A. O. Walker[6] withdrew the genus *Seba* from this family, establishing for it a separate family *Sebidæ*.

Genus LEUCOTHOE, *Leach.*

Leucothoe, Leach, Edinb. Encycl., vii., 1814, p. 432.
Leucothoe, Stebbing, Das Tierreich, xxi., 1906, pp. 163, 724.
Leucothoe, Chevreux, Bull. Inst. Océanogr. Monaco, No. 117, 1908, p. 11.

In 1901 Walker added the species *L. euryonyx* and in 1904 *L. hornelli* and *L. stegoceras*, which are named but not described in "Das Tierreich." Chevreux in 1908 instituted the new species *L. rostrata*.

LEUCOTHOE COMMENSALIS, *Haswell.*

Stations 28, 44, 48.

Leucothoe commensalis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 261, pl. x., fig. 3.
Leucothoe commensalis, Stebbing, Das Tierreich, xxi., p. 166.

It is perhaps only a matter of taste or convenience whether this should be taken as a distinct species or as a variety of *L. spinicarpa*, Abildgaard. In the "Thetis" specimen the hand of the second gnathopod contracts towards the finger hinge much more than in Sars' figure of the European form, and has a stronger

[6] Walker.—Nat. Antarctic Exp. iii., 1907, p. 37.

tuberculation of the palm in accord with Haswell's description. The postero-lateral angle of the third pleon segment is without sinus. Yet a specimen sent me some years ago under this name from the Australian Museum had this sinus, and so had the "Thetis" specimen from off Manning River.

Length of specimen from off Wollongong 17 mm.

Localities.—Off Manning River; off Coogee; and off Wollongong, 55-56 fathoms.

Genus PARALEUCOTHOE, Stebbing.

Paraleucothoe, Stebbing, Ann. Mag. Nat. Hist., (7), iv., 1899, p. 208.

Paraleucothoe, Stebbing, Das Tierreich, xxi., 1906, p. 169.

PARALEUCOTHOE NOVÆ-HOLLANDIÆ, *Haswell.*

Station 48.

Leucothoë novæ-hollandiæ, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 329, pl. xx., fig. 2, e, f, g, g1.

Locality.—Off Wollongong, 55-56 fathoms. One specimen.

Family OCHLESIDÆ.

This family, being founded for a single specimen, offers at present no combination of characters that can properly be separated from those of the single genus. The unique feature of palpless maxillipeds separates it from all hitherto known families of the tribe Gammaridea, but the possibility is still open that the same characteristic may be discovered in some future genus otherwise on no terms of alliance with the present.

Genus OCHLESIS, *gen. nov.*

Upper and lower lips apically acute. Mandible without molar, the three-jointed palp slender, set far back. First maxillæ without palp, outer plate slender. Second maxillæ with both plates slender, outer much the longer. Maxillipeds slender, entirely devoid of palp, the inner plates long and very narrow, the outer plates closely adjacent, very slightly armed. First gnathopods simple, from the rather elongate third joint onwards very slender. Uropods rather elongate, outer ramus shorter than the inner.

The name *Ochlesis*, from ὄχλησις, disturbance, refers to the unique character of the maxillipeds, which, so far as an exception can do it, overthrows the leading distinction by which the

Hyperiidea are separated from the tribe Gammaridea and the family Caprellidæ. Normally, the so-called palp of the maxillipeds consists of the last four joints of the appendage in the Amphipoda. These are reduced to two in Kröyer's genus *Lafystius* of the Gammaridea. In the tribe Caprellidea the family Cyamidæ includes species from which the palp of the maxilliped disappears in the adult stage, though it may be, and in one case certainly is, present in the young[7]. It would, in my opinion, be very inexpedient to see in these rare exceptions any ground for fusing the tribes together.

OCHLESIS INNOCENS, *sp. nov.*

(Plate xlviii.).

Stations 35, 57.

Head rostrate, rostrum bending over between the first antennæ, lateral corners triangularly produced between first and second antennæ. Peraeon and first three segments of pleon sharply carinate, fourth segment of pleon rather elongate, fifth and sixth apparently coalesced into one short segment. Body much compressed, except (in female) at middle of peraeon, the specimens in general much resembling *Lepidepecreum foraminiferum* of the Challenger Expedition. First side-plate with bulging front margin, second longer, nearly parallel-sided, third again longer, similar in shape except for a widening both ways at the top, fourth wider than the rest, the lower part of the hind margin deeply excavate, the fifth at the upper part shallowly produced forward. Postero-lateral angles of first two pleon segments rounded, the third having a little straight tooth, which is not produced from the lower margin but from a point just above it. Eyes of moderate size, near the margin of the lateral process of the head, pale in preserved specimens. First antennæ having the first joint deep, produced below into a long tooth, second joint longer but less deep than the first, similarly produced, the tooth reaching beyond the third small joint and more than half-way along the small conical flagellum, which is tipped with several filaments and setæ attached to the conical joint and to two or three microscopical following joints. Second antennæ about as long as first but otherwise much slighter, last joint of peduncle the longest, flagellum conical, smaller than that of the first antennæ, with a minute second joint tipped with setæ. Upper lip membranaceous, broad, narrowing to a little bulb, followed by an acute apex. Lower lip matching the upper, the principal

[7] P. Mayer—Fauna Flora Neapel, xvii., 1890, p. 146.

lobes having acute apices which meet or even cross; the mandibular processes narrow. Mandibles narrow, except at base, cutting-plate forming a tongue-like widening, without teeth (except that in one specimen there is a minute projection at each end of the cutting edge); there is no secondary plate or molar. All three joints of the palp rather long, second longer than the first, both smooth, third slightly longer than second, with three spinules at the apex. First maxillæ seemingly with small unarmed inner plate, outer plate long and narrow, narrowing distally, then widening a little where five spines form an oblique apical row. No vestige or vestigial mark of palp could be seen in the flattened maxillæ of the smaller specimen, but in the folded maxillæ of the larger specimen there is a very doubtful appearance of such a vestige. Second maxillæ with few spines on oblique apex of inner plate and a few on the still more oblique apex of the much longer outer plate, the distal spines of which are long. Maxillipeds membranaceous, having a few spines at the apices of the extremely narrow inner plates, the outer plates reaching a little beyond them and together forming a narrow oval, with two or three spinules distally on the inner margins.

First gnathopods, having the second joint the longest and widest, narrowing downwards, third joint longer than fourth, as commonly in the second gnathopods of the Lysianassidæ, and as in the first gnathopods of some species of the genus *Iphimedia*, fifth joint subequal in length to the slender slightly-curved sixth, which has its apex occupied by the small finger, so as to be in no degree subchelate, thus differing from the chelate but otherwise rather similar limbs of *Iphimedia minuta*, Sars, and *Odius carinatus* (Bate). Of the latter species the lips and maxillæ are also reminiscent. Second gnathopods—side-plates deep, second joint in width equalling (true length of) the side-plates, third joint much shorter than the conical fourth, fifth on its outer margin subequal in length to the narrow palm-less sixth, beside which its under margin is produced into a long sharp tooth, the tip of which may be opposed to the little unidentate finger, thus making the limb complexly subchelate. The branchial vesicle is long and narrow, the marsupial plate extensive.

The first peraeopod has the side-plates deeper than those of the second gnathopods, those of the second peraeopods are less deep but wider, with the lower part of the hind margin excavate. In these limbs the second joint is moderately wide with sides nearly straight, third joint short, conspicuously narrower than the fourth joint, fifth decidedly longer than fourth, sixth slightly longer than fifth, finger long, narrow, curved. Marsupial plates extensive.

Third, fourth and fifth peraeopods very similar to one another and to the preceding pairs, but with the second joint more

expanded, bulging below in front, behind produced downward over the third joint, the fifth and sixth joints a little more robust. The pleopods carry one or two coupling spines on the peduncle, and the rami have about seven joints. The first uropods have the peduncle much longer than the rami, which are slightly armed, a little unequal. In the second uropods the peduncle equals the longer inner ramus; in the third the peduncle is longer than the slight outer ramus, but a little shorter than the inner ramus, which is intermediate in length between the two rami of the second pair.

Telson simple, triangular, somewhat rounded above, reaching more than half-way along the peduncle of the third uropods. A process or stout spine projects from the under surface a little above the middle.

Length of one specimen, about 2·5 mm.; of the other, about 3 mm.

The specific name *innocens* is given to this exceedingly interesting little creature to guard it against any unworthy implication in connexion with its generic name. The sharpened points of several of its oral appendages, however, rather imply that it penetrates the tissues of other animals to suck their juices for its nutriment.

Localities.—Off Port Hacking and Wata Mooli.

Family ACANTHONOTOZOMATIDÆ.

Acanthonotozomatidæ, Stebbing, Das Tierreich, xxi., 1906, p. 210.

To this family must be added the genus *Pariphimedia*, Chevreux[8]. The species for which the genus was instituted, *P. integricauda*, from the Wandel, differs from the rest of the family, except *Iphimedia ambigua*, Haswell, in having the telson not emarginate, but apically entire, as the specific name declares. The new genus differs from all the older genera except *Odius* in having the palp of the first maxilla almost rudimentary and one-jointed. From *Odius* it is distinguished by having the second gnathopods slender and chelate instead of subchelate and rather robust. I incline to think that the very large twelve-toothed accessory plate attributed to the left mandible of *P. integricauda*, is in reality the principal plate preparing for the next exuviation. Its position, as figured, would otherwise be almost unaccountable.

IPHIMEDIA, *H. Rathlee.*

Iphimedia, H. Rathlee, N. Acta Acad. Leop., xx., i., 1843, p. 85.
Iphimedia, Stebbing, Das Tierreich, xxi., 1906, p. 214.
Iphimedia, A. O. Walker, Ann. Mag. Nat. Hist., (7), xviii., 1906, p. 150.
Iphimedia, Walker, Nat. Antarct. Exp., iii., 1907, pp. 4, 27.

[8] Chevreux—Bull. Soc. Zool. Fr., xxxi., 1909, p. 39.

In the recent definition the maxillipeds are considered to agree with those of *Panoploea*, Thomson, and they sometimes do, but in *I. pulchridentata* of the Challenger Expedition, the second joint of the palp is an exception, not being produced along the inner margin of the third, as it is in *Panoploea*, *Pariphimedia*, and some species of *Iphimedia*, among them being *I. discreta*, sp.nov. That species, however, in the slenderness of its mandibular palp agrees less with its own genus and the other two just mentioned than it does with *Odius*. Such interlacing of characters may at least be regarded as some indication that the family is a natural one.

In 1906, Walker added three large antarctic species to the genus, *I. echinata*, *I. longipes*, and the densely spinose *I. hodgsoni*.

IPHIMEDIA AMBIGUA, *Haswell.*

Iphimedia (?) *ambigua*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 327, pl. xxiv., figs. 2, 2*x*.

Iphimedia (?) *ambigua*, Haswell, Austr. Mus. Cat. v., Crust., 1882, p. 241.

Panoploea ambigua, Stebbing, Das Tierreich, xxi., 1906, p. 213 (without description).

Head with long pointed rostrum. First and seventh peraeon segments much longer than any of the intervening five. Seventh peraeon segment and first to third pleon segments dorsally produced into a pair of strong teeth. First to fourth side-plates successively deeper, the fourth emarginate above, in the figure rounded below, the fifth to the seventh each with a tooth-like postero-lateral angle, the first three pleon segments being similarly provided, the tooth strong only in the third segment, and there surmounted by a larger upturned tooth midway between the lower angle and the dorsal tooth. Eyes, in figure, rounded oval. First antennæ rather shorter than second antennæ, the first joint rather large. First gnathopod slender, filiform. Second gnathopod slender, subchelate. Third peraeopod with second joint produced above into an acute tooth, fourth peraeopod with small tooth on this joint above and below, fifth peraeopod with hind margin serrate and lower angle produced into a tooth. Third uropod with inner ramus longer than the outer, two-jointed. Telson scale-like, entire, the detail figure 2*x* representing it in dorsal view as oval, without the least trace of emargination.

By the last character this species is distinguished from all other known species of *Iphimedia*, and agrees only with *Pariphimedia integricauda*, Chevreux. Its position in the family remains ambiguous, so long as the mouth organs continue unknown, but

I have restored it to the present genus on account of the striking resemblance which it bears to the next species, that being in my opinion an undoubted *Iphimedia*.

Haswell gives the colour as red with brown dots, and the length at first as 3/30 in., but subsequently as 3/20 in., thus varying between 2·5 and 3·75 mm. The latter statement was no doubt a correction of the earlier one. In 1882 he adds Port Jackson (dredged) as the place of capture. This form was not included in the "Thetis" collection.

IPHIMEDIA DISCRETA, *sp. nov.*

(Plate xlix.)

Station 57.

This species is in many respects so closely in agreement with *Iphimedia obesa*, Rathke, that it will be convenient to confine the description almost entirely to those points in which it differs from Rathke's species.

The specimen examined was an adult female, containing about eight large eggs, its first antennæ imperfect, the second broken, and the last three joints missing from all the peraeopods. Also each of the third uropods had lost one of the rami.

The tumid peraeon has the first and last segments very long in comparison with the shortness of the intervening five, so far agreeing with *I. ambigua* rather than *I. obesa*. In common with both, this species has the rostrate head, the seventh peraeon segment and the first three segments of the much compressed pleon each with a pair of postero-dorsal teeth. Of the side-plates the first has the lower angle quadrate instead of acute, but the rest are in agreement with *I. obesa*, the last three not having a tooth-like postero-lateral angle as in *I. ambigua*. In like manner the produced tooth at the lower angle of the third pleon segment agrees with the former species in being surmounted by a larger tooth near to it, not remote as in the latter.

The eyes have very numerous small components. The first joint of the first antennæ is apically produced into one long and two small teeth. In the second antennæ the basal joints are short, the penultimate joint of the peduncle doubtful, the ultimate slender, carrying a flagellum of twenty-five joints, this part detached, but entangled with the other appendages.

The mouth-organs differ from those of *I. obesa* as figured by Professor Sars in the following points. On one mandible the accessory plate is a long narrow piece, minutely denticulate at its apex, on the other it is either wanting or in coalescence with the principal cutting edge to which it in the latter case contri-

butes a crenulate border. The palp is very slender, the first joint much broader than the third and nearly as long, their combined length not equalling that of the second joint. The lower lip has the principal lobes acute, the inner coalesced lobes rounded, the mandibular processes large. The first maxillæ have an elongate palp overtopping the outer plate, of which the apical margin is very oblique, furred with setules below the ten mostly denticulate spines, while the well developed inner plate carries only six setæ.

The slender first gnathopods have the flexuous second joint and general character as in *I. obesa*, but are strongly distinguished by the great length of the third and fifth joints, each of which is subequal in length to the sixth, including its delicate chela-forming thumb. The second gnathopods and the peraeopods differ little from those of *I. obesa*. The third pair have the second joint more strongly serrate on the hind margin than in the species compared. The marsupial plates are very broad on the second peraeopods, but not so on the other limbs to which they belong.

The telson has the sides convex, with a shallow concave emargination of the apical border flanked on either side by a little tooth with an intervening spinule. In *I. longipes*, Walker, the telson is rather deeply notched, besides that the animal is ten times as long as the present.

Length of adult female about 3 mm. For the same sex Sars gives the length as reaching 12 mm. in *I. obesa*.

It may be observed that in the relative dimensions of the peraeon segments and in the character of the mandibular palp this species agrees with Bate's *I. eblanæ*, which in "Das Tierreich" I have transferred to *Panoploea*, Thomson, along with species in which the palp of the first maxilla does not reach the apex of the outer plate.

Locality.—Off Wata Mooli, from depth of 54-59 fathoms.

Family LILJEBORGIIDÆ.

Liljeborgiidæ, Stebbing, Ann. Mag. Nat. Hist., (7), iv., 1899, p. 211.

Liljeborgiidæ, Stebbing, Das Tierreich, xxi., 1906, p. 229.

Lilljeborgiidæ, Walker, Nat. Antarctic Exp., iii., 1909, pp. 5, 35.

Lilljeborgiidæ, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 475.

The character assigned to this family, that the pleon has one or more of the segments dorsally dentate, should have been qualified by the adverb *usually*, since the species *Liljeborgia aequabilis*, described in 1888, forms an exception, though in other respects clearly inseparable from the typical genus.

Genus LILJEBORGIA, *Bate.*

Liljeborgia, Bate, Cat. Amphip. Brit. Mus., 1862, p. 118.

Liljeborgia, Stebbing, Das Tierreich, xxi., 1906, pp. 230, 726, 741.

The very small species, *L. proxima*, added recently to this genus by Chevreux from the Gambier Archipelago, is distinguished from the European *L. pallida*, Bate, and *L. brevicornis*, Bruzelius, especially by the very long finger of the fifth peraeopods. In this character it agrees with *L. macronyx*, from which it is separated by the possession of large eyes and the deep apical notches in the lobes of the telson. From both of these the Australian *L. aequabilis* is distinguished not only by its greatly superior size, but also by the absence of dorsal dentation, which occurs to some extent in all the other known species of the genus, including the obscure *L. pugettendis*, Dana, which has the fourth segment of the pleon dorsally produced into a sharp tooth.

LILJEBORGIA AEQUABILIS, *Stebbing.*

Station 44.

Liljeborgia aequabilis, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 988.

Liljeborgia aequabilis, Stebbing, Das Tierreich, xxi., 1906, p. 741.

The description given in the "Challenger" Report holds good for the "Thetis" specimens. The characters also are in so close an agreement with those of *L. brevicornis*, Bruzelius, that the student may be referred to the figures and description of that species supplied by Professor G. O. Sars in his Crustacea of Norway,[8] (under the name *L. pallida*, Bate). Some distinguishing points may be briefly noticed. The first and second side-plates of the peraeon have no projecting tooth at the lower hind corner. The third pleon segment has a little emargination just above the small postero-lateral tooth. The finger of the first gnathopod has nine serrations, not strong but only discernible under high magnification. In the second gnathopods the serrations are conspicuous, seventeen in number, with the palm crenulate for a space near the hinge of the finger. The hind margin of the second joint in the last three peraeopods is very feebly serrate. The slender finger of the fifth pair is about two-fifths as long as the sixth joint. The deeply divided telson has two unequal spines, neither very long, in the rather shallow

[8] Sars—Crust. Norway, i., 23, 1894, p. 530, pl. clxxxvii.

apical notch of each lobe. The outer lobe of the notch is not longer than the inner. The telson itself is rather more than twice as long as the greatest breadth.

Length of one specimen about 9 mm.; of the other, a female, about 14 mm.

What value for specific distinction should be attributed to the presence or absence of small dorsal cusps and similar minutiæ is still an open question[9]. The question exercised a soporific influence on my mind, so that in describing *Liljeborgia* for "Das Tierreich" it was only at the last moment that I thought of mentioning *L. æquabilis*. Again, in dealing with the "Thetis" specimens I had chosen a new name for them before recalling their agreement with the species already described from South Australian waters. Thus, whatever my doubts, on two independent occasions I have been led to regard this form as a distinct species.

Locality.—Off Coogee.

Family ŒDICEROTIDÆ.

Œdicerotidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 235, 726.

Genus ŒDICEROIDES, *Stebbing.*

Œdiceroides, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 843.

Œdiceroides, A. O. Walker, Ann. Mag. Nat. Hist., (7), xviii., 1906, p. 15.

Œdiceroides, Stebbing, Das Tierreich, xxi., 1906, p. 267.

Œdiceroides, A. O. Walker, Nat. Antarct. Exp., iii., 1907, pp. 4, 22.

In 1906 Mr. Walker added to the genus the large species *Œ. calmani*, and in 1907, transferred the species which in 1903 he had described as *Œdiceros newnesi* to *Œdiceroides*. Both these species differ rather strikingly from the three "Challenger" species by the much less conspicuously developed frontal process, and apparently by the more normal development of the eyes.

ŒDICEROIDES ORNATUS, *Stebbing.*

Stations 35, 38.

Acanthostepheia ornata, Stebbing, Ann. Mag. Nat. Hist., (5), xi., 1883, p. 203.

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[9] See A. O. Walker—Trans. L'pool. Biol. Soc., xxiii., 1907, p. 102.

Œdiceroides ornata, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 855, pl. lxiv.

Œdiceroides ornatus, Stebbing, Das Tierreich, xxi., 1906, p. 270.

In the "Challenger" specimen from off East Moncoeur Island the flagellum of the first antennæ was missing. In a specimen measuring 7·5 mm. in length this flagellum is nine-jointed. The little process to which the ventral carina of the rostrum is produced is well seen in this specimen.

Localities.—A specimen, much damaged, was obtained off Port Hacking, another from Botany Bay.

Family TIRONIDÆ.

Tironidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 273, 727.

Tironidæ, Stebbing, Ann. S. African Mus. vi., Crust., 1908, p. 79[10], pl. iv.

Genus BRUZELIA, *Boeck.*

Bruzelia, Boeck, Forh. Selsk. Christiania, 1870, (1871), p. 189.

Bruzelia, Stebbing, Das Tierreich, xxi., 1906, p. 274.

In the specimen representing the genus from Australia the body was not especially indurated. The species to be described agrees with *B. typica*, Boeck, in having the second joint of the fifth peraeopods narrowly oblong, but with *B. tuberculata*, Sars, in the acuminate rostrum. The peraeon is not dorsally smooth as in the former species and is much more sharply carinate than in the latter.

BRUZELIA AUSTRALIS, *sp.nov.*

(Plate l.).

Station 57.

From *B. tuberculata*, with which in many respects it remarkably agrees, this species is distinguished by its much smaller size, the character of its dorsal carina, and the narrowness of the second joint of the last peraeopods.

All the segments of the peraeon and first two of the pleon raised to an acute carina with the apically pointed processes successively larger, the first segment having also a point directed forward over the head. The first two segments are short, closely united, with the carina very low. The lower margins of the

[10] *Tiron thomsoni* is here given in error for *Tiron thompsoni*.

peraeon segments form a carina, which is continued on the sides of the first two pleon segments. The second pleon segment has its lower margin produced into a simple tooth ; the third has the dorsal carina low and not apically pointed, but its postero-lateral angle forming a rather strongly recurved tooth.

No eyes could be discerned. The first antennæ have the first joint slightly bent, as long as the second and much stouter, the third joint about half as long as the second and more than twice as long as it is broad. The flagellum consists of seven or eight unequal joints, each with an apical filament, and all combined as ong as the last two joints of the peduncle. The secondary flagellum is slender, its single joint about equal in length to the first of the principal. The second antennæ have the fourth joint slightly longer than the fifth, which is longer than the second joint of the first antennæ. The flagellum is seven-jointed.

The mouth-organs show close agreement with those which Sars has described for the genus and figured for *B. typica*. The apical border of the upper lip is more regularly rounded, without the flattened appearance given it by Sars. The stout compact mandibles seem to have a microscopic accessory cutting plate. In the maxillæ and maxillipeds there is nothing essentially distinctive.

The first and second gnathopods and first and second peraeopods are scarcely distinguishable from those of the two northern species. The first three side-plates have the lower front corner produced forward, well rounded in the first pair, narrowly so in the second, acute in the third. In the fourth, which has the hind margin excavate, the lower margin is rounded and produced acutely backward as in *B. typica*. For *B. tuberculata*, Sars figures this plate as having an obliquely emarginate lower edge. The detailed figure, lettered p^4, as according to his notation belonging to what is here called the second peraeopod, must certainly be a mistaken lettering for p^3, the first peraeopod. The third, fourth, and fifth peraeopods agree nearly with those of *B. typica*, but have the hind margin of the narrowly oblong second joint not smooth but serrate; the broad, distally produced fourth joint has an extra proximal expansion only in the fifth pair, of which the second joint is distinguished by having the lower hind corner sharply bidentate, not blunt or rounded.

The coupling spines on the peduncles of the pleopods are rather long and slender ; the rami are nine- to ten-jointed.

The first uropods have the slender outer ramus about three-fourths as long as the inner, with the length of the peduncle intermediate. In the second pair the peduncle is short, the outer ramus scarcely so long as that of the first pair, but the inner very

large, broad in the first half, then tapering to a fine point, which reaches much beyond the much narrower, subequal rami of the third pair. These are unarmed, more than twice as long as their peduncle, the inner the broader. They reach considerably beyond the long, proximally broad, distally tapering telson, which ends in a fine point.

The single specimen, a female with narrow fringed marsupial plates, measured about 3 mm. In the other two species the length of adult female is given as 6 mm.

Locality.—Off Wata Mooli, 54-59 fathoms.

Family CALLIOPIIDÆ.

Calliopiidæ, Sars, Crust. Norway, i., 19, 1893, p. 431.
Calliopiidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 285, 727.

To the fifteen genera of this family defined in "Das Tierreich" the appendix adds *Bouvierella*, Chevreux, 1900, and *Oradarea*, Walker, 1903, to which, in 1908, Professor Holmes further adds the genus *Gracilipes*, and in 1909 Walker provisionally placed in this family the genus *Chagosia*. I have already pointed out the likeness between Walker's *Oradarea* and *Leptamphopus*, Sars. *Djerboa furcipes*, a new genus and species in the family Pontogeneiidæ instituted by Chevreux for an Antarctic specimen, differs from *Oradarea longimana*, Walker, in having the telson not entire but deeply cleft, and in some other points, but in general shows a remarkable similarity.

Genus HARPINIOIDES, Stebbing.

Harpinioides, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 936.
Harpinioides, Stebbing, Das Tierreich, xxi., 1906, p. 298.

HARPINIOIDES DREPANOCHEIR, Stebbing.

Station 59.

Harpinioides drepanocheir, Stebbing, Chall. Rep., Zool., xxix 1888, p. 937, pl. lxxxii.
Harpinioides drepanocheir, Stebbing, Das Tierreich, xxi., 1906, p. 298.

A single specimen, female, of this species, measuring 6 mm. or a little over, was dredged by the "Challenger" at a depth of 127 fathoms off Kerguelen Island. It does not appear to have been met with again till obtained by the "Thetis." This specimen shows no signs of being a female. Otherwise it appears to be in

complete agreement with the "Challenger" specimen, except that it is smaller and has two setæ on the inner plate of the first maxillæ instead of only one seta. Attention may be called to the two long setæ on the inner margin of the inner plate in the second maxillæ, and to the distally widened penultimate joint of the maxillipeds. Length 3 mm.

Locality —Off Wata Mooli, 54-59 fathoms.

Family ATYLIDÆ.

Atylidæ, Sars, Forh. Selsk. Christiania, No. 18, 1882, p. 26.

Atylidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 327, 728.

Genus NOTOTROPIS, *A. Costa.*

Nototropis, Costa, Rend. Soc. Borbon., n. ser., ii., 1853, pp. 170, 173.

Nototropis, Stebbing, Das Tierreich, xxi., 1906, pp. 329, 728.

NOTOTROPIS HOMOCHIR, *Haswell.*

Stations 28, 35, 37, 38, 57.

Atylus homochir, Haswell, Proc. Linn. Soc. N.S. Wales, x., 1885, p. 101, pl. xiii., figs. 5-7.

Nototropis homochir, Stebbing, Das Tierreich, xxi., p. 333, figs. 77, 78.

In a specimen from off the Manning River the second maxillæ showed lateral setæ on the inner plate, which are not displayed in the figure of that appendage in the report on the "Challenger" Amphipoda. Also the broad second joint of the fifth peraeopods has a more decided apical lobe to the hind margin, and the inner apical point to each lobe of the telson is more produced than the outer point, thus interfering with the subtruncate appearance.

Localities.—Off Manning River; off Port Hacking; Botany Bay, 50-52 fathoms; off Wata Mooli, 54-59 fathoms.

Family EUSIRIDÆ.

Eusiridæ, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 953.

Eusiridæ, Chevreux, Résult. Camp. Monaco, xvi., 1900, p. 65.

Eusiridæ, Stebbing, Das. Tierreich, xxi., 1906, pp. 338, 728.

Eusiridæ, Walker, Nat. Antarct. Exp., iii., 1907, pp. 4, 30.

Eusiridæ, Chevreux, Bull. Inst. Océanogr. Monaco, No. 121, 1908, p. 12.

Six genera of this family are defined in "Das Tierreich," and the appendix adds *Eusirogenes*, Stebbing, 1904. Chevreux in 1908, established an eighth genus under the name *Eusirella*.

Genus EUSIROIDES, *Stebbing.*

Eusiroides, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 969.

Eusiroides, Chevreux, Comp. Rend. Assoc. Franç., (27), ii., 1899, p. 479.

Eusiroides, Chevreux, Résult. Camp. Monaco, xvi., 1900, p. 65.

Eusiroides, A. O. Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 264.

Eusiroides, Stebbing, Das Tierreich, xxi., 1906, pp.345, 729.

Eusiroides, Walker, Trans. Linn. Soc., xii., 1909, pp. 325, 333.

In 1899 Chevreux gave the name *E. dellavallei* to a Mediterranean species which had been described by Della Valle in 1893 as identical with the Australian *E. caesaris*. This latter species and *E. pompeii*, also described in the "Challenger" Report I have since regarded as synonymous with *E. monoculoides*, Haswell. Della Valle's suggestion, that *Megamœra fasciculata*, G. M. Thomson, 1880, belongs to the present genus, is, I think, negatived by the gnathopods, which have the wrist comparatively elongate, instead of short and cup-shaped, at least in one sex. In 1900 Chevreux added to the genus the little species *E. sarsi* taken from small depths at the Azores and Teneriffe, and in 1904 Walker briefly described a scarcely larger species from Ceylon waters as *E. orchomenipes*. Along with this he found specimens which he considered as a variety of *E. caesaris*, writing that it "agrees with the type except as regards the pleon segments, which are not dorsally produced, and the third has the hind margin only slightly convex, with but three teeth on the lower third part; the posterior angle is a rounded right angle (fig. 22, pl.[3]). The telson is divided more than half its length. Length of female with ova 8 millims." Walker in 1909 briefly distinguishes a new species as *Eusiroides diplonyx*.

EUSIROIDES CRASSI, *Stebbing.*

Station 57.

Eusiroides crassi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 977, pl. xc.

Eusiroides crassi, Stebbing, Das Tierreich, xxi., 1906, p. 346.

A female specimen, carrying several well developed young ones, appears to agree fairly well with the original description

of this species, but the principal mark by which it was distinguished from *E. caesaris* and *E. pompeii* depended on the unserrated hind margin of the third pleon segment. The present specimen has two teeth at the postero-lateral corner. Walker's specimens above-mentioned have three teeth a little above that corner. In the "Challenger" *E. caesaris* the denticles reached nearly the top of the lower lobe of the hind margin, but little more than half-way round it in *E. pompeii*. The telson of the present species is cleft to less than half the length, but its lateral margins are sinuous, each carrying a group of three setules level with the top of the cleft. In the mandibles the second joint of the palp though much shorter is much broader than the third. In the first maxillæ the first joint of the palp is more than half as long as the second, which has not one only but two setæ on its outer margin. The first joint of the palp in the maxillipeds reaches the extremity of the outer plates. The side-plates of the first gnathopods are strongly produced forward, and the hind lobe of the fifth joint is very broadly rounded. Length fully 13 mm.

Whether this can be retained as a species distinct from *E. monoculoides* seems doubtful.

Locality.—Off Wata Mooli, from 54-59 fathoms.

EUSIROIDES MONOCULOIDES, *Haswell.*

Station 28.

Atylus monoculoides, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1880, p. 327, pl. xviii., fig. 4, f, g.

Eusiroides monoculoides, Stebbing, Das Tierreich, xxi., 1906, p. 345.

Eusiroides monoculoides, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 478.

A female specimen from Station 28 has the large dark eyes completely meeting at the top of the head so as to justify, so far as general appearance goes, the specific name chosen by Haswell. The second joint of the palp in the first maxilla has two setæ on its outer margin. The third pleon segment has the lower part of the hind margin serrate as in *E. pompeii* figured in the "Challenger" Report. The telson is not cleft fully to the centre.

Locality.—Off Manning River. M. Chevreux records specimens from a lagoon in the Tuamotu Archipelago.

Family GAMMARIDÆ.

Gammaridæ (part), Leach, Edin. Encycl., vii., 1814, p. 432.

Gammaridæ, Stebbing, Das Tierreich, xxi., 1906, pp. 364, 729.

Gammaridæ, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 478.

Gammaridæ, Chevreux, Trav. Soc. Imp. St. Petersbourg, xxxvii., pt. 2, 1908, p. 91.

To the very numerous genera of this extensive family, defined or mentioned in "Das Tierreich," Chevreux added in 1908 the genus *Issykogammarus*, and in 1909 the genus *Metacrangonyx*.

Genus MELITA, *Leach*.

Melita, Leach, Edin. Encycl., vii., 1813, p. 403.

Melita, Stebbing, Das Tierreich, xxi., 1906, pp. 421, 732.

Melita, Chevreux, Bull. Inst. Océanogr. Monaco, No. 122, 1908, p. 6.

To the twelve species of this genus described in "Das Tierreich" must be added three species there named, but not described, *M. richardi*, Chevreux, 1900, *M. parvimana*, Holmes, 1903, *M. zeylanica*, Stebbing, 1904. *M. tenuicornis*, Walker, 1904, reinstates Dana's earlier name for it, *M. inaequistylis*, which was left among uncertain species in "Das Tierreich." *Melita grandimana* was added to the genus by Chevreux in 1908,

MELITA FRESNELII (*Audouin*).

Stations 28, 37.

Gammarus fresnelii, Audouin, Descrip. Égypte, i., 4, 1826, pl. xi., fig. 3, Savigny.

Melita australis, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 264, pl. ix., figs. 6, a, b, 7, a, b.

Melita anisochir, Walker, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 270, pl. iv., fig. 28.

Melita fresnelii, Stebbing, Das Tierreich, xxi., 1906, p. 423.

Melita fresnelii, Walker, Trans. Linn. Soc., xii., 4, 1909, p. 334.

The enormously developed hand of the second gnathopod in the male of this species seems to be very characteristic. It would probably be very inconvenient for the animal to have both members of the pair equally enlarged, but see note on *Maera inaequipes*, p. 599.

Localities.—Off Manning River; Botany Bay, 50-52 fathoms; a single specimen of the male.

Specimens from Station 57, off Wata Mooli, agree with Walker's figures of the female which in 1904 he names *Melita anisochir*, Kröyer.

Genus PARACERADOCUS, *Stebbing.*

Paraceradocus, Stebbing, Trans. Linn. Soc., (2), vii., 1899, p. 426.
Paraceradocus, Stebbing, Das Tierreich, xxi., 1906, 429.
Paraceradocus, Chevreux, Exp. Antarct. Française, Amphip., 1906, p. 93.

The new species to be added to this genus labours under the disadvantage of being known only in the female sex, and, of the two specimens available, only one had a first antenna in a moderately satisfactory condition, neither had more than three short basal joints of the second antennæ. From the only other species at present included in the genus, *P. miersii* (Pfeffer), which attains a length of nearly two inches, it is at once distinguished by its diminutive size as well as the serrations of the pleon and other characters.

PARACERADOCUS MICRAMPHOPUS, *sp.nov.*

(Plate li.)

Station 57.

Head without conspicuous rostrum. The pleon segments from first to sixth all dorsally denticulate, much as in *Ceradocus rubromaculatus* (Stimpson), the third segment having the denticulation continued, after an interruption, down to the strongly produced, slightly up-curved postero-lateral angle.

Eyes of moderate size, near the obtuse lateral lobes of the head. First antennæ with rather stout first joint, followed by a slender, rather longer second joint, the third not long, the flagella slender, the primary incomplete, with twelve joints, the secondary four or five-jointed.

Upper and lower lips figured from partially unsuccessful dissections. Mandibles, with secondary plate as usual stronger on one of the pair than on the other, spine-row of six or seven spines, that nearest the secondary plate more conspicuously denticulate than the rest, molar normal, third joint of palp a little longer than the second. First maxillæ with nine or ten setæ on the inner plate, eleven spines on the outer, second joint of palp elongate. Second maxillæ with fringe of setæ along most of its inner margin. Maxillipeds with three little teeth on apical border of inner plate, outer fringed with nine or ten spine teeth,

followed by three spines; second joint of palp reaching a little beyond outer plate.

First gnathopods. The side-plate distally widened, its lower border serrate, with a tooth at the front corner. The fifth and sixth joints are subequal both as to length and breadth, each more than twice as long as broad, the palm short, sloping, not sharply defined either by its angle or its palmar spine, the finger curved, a little serrate, matching the palm.

Second gnathopods longer but more slender than the first, the fifth joint a little shorter than the sixth, which is more than four times as long as broad, parallel-sided to the short very oblique palm; finger as in the first pair.

The first two pairs of peraeopods are alike, slender throughout, the branchial vesicles large, the marsupial plates narrow. The third and fifth pairs are longer than the preceding but shorter than the fourth. Like the latter they have the second joint moderately expanded, narrowing downward, with serrate hind margin, the finger nearly straight.

The first uropods have the inner branch as long as the peduncle, the outer a little shorter; in the second the shorter outer branch is subequal to the peduncle; the peduncle of the third is longer than that of the second, but much shorter than the spinose lanceolate rami.

The telson, considerably longer than broad, is divided almost to the base. The lobes end acutely and have spines along both margins. This appendage is, therefore, very different from the corresponding part in *Ceradocus rubromaculatus*. Length of specimen 4·5mm.

The specific name alludes to the smallness of both pairs of gnathopods, but this will probably not affect the still unknown male sex.

Locality.—Off Wata Mooli, depth 54-59 fathoms.

Genus CERADOCUS, *A. Costa.*

Ceradocus, A. Costa, Rend. Soc. Borbon., n. ser., ii., 1853, p. 170.
Ceradocus, Stebbing, Das Tierreich, xxi., 1906, p. 430.

CERADOCUS RUBROMACULATUS (*Stimpson*).

Stations 14, 44, 48, 49.

Gammarus rubromaculatus, Stimpson, Proc. Acad. Nat. Sci. Philad., vii., 1855, p. 394.
Ceradocus rubromaculatus, Della Valle, Fauna Flora Neapel, xx., 1893, p. 720.

Ceradocus rubromaculatus, Stebbing, Das Tierreich, xxi., 1906, p. 430.

Ceradocus rubromaculatus, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 479, fig. 6a-g.

Ceradocus rubromaculatus, Walker, Trans. Linn. Soc., xii., 4, 1909, p. 334.

Localities.—Off Norah Head; off Coogee; off Wollongong, 55 to 56 fathoms; off Port Kembla.

Genus MÆRA, *Leach.*

Mœra, Leach, Edin. Encycl., vii., 1813, pp. 403, 432.

Mœra, Stebbing, Das Tierreich, xxi., 1906, pp. 433, 732.

In addition to the twelve species of this genus described in "Das Tierreich," three are named in the appendix, *M. dubia*, Calman, 1898; *M. hirondellei*, Chevreux, 1900; *M. othonides*, Walker, 1904. To these should be added *M. prionochira*, v. d. Brüggen, 1907; *M. spinicauda*, Holmes, 1908; *M. rathbunæ*, Pearse, 1908.

MÆRA INÆQUIPES (*A. Costa*).

Stations 44, 48.

Amphithoe inæquipes, A. Costa, in Hope's Catal. Crost. Ital., 1851, p. 45.

Mœra scissimana, A. O. Walker, in Herdman's, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 273, pl. v., fig. 32.

Mœra inæquipes, Stebbing, Das Tierreich, xxi., 1906, p. 435.

The specimens which I assign to this species do not justify the specific name, inasmuch as the second pair of gnathopods appear to be, as a rule, quite alike in size and sculpture. They are very large and have the deep central notch in the broad, almost transverse palm, which suggested Costa's later name *Gammarus scissimanus*, supposed to be a different species. In the specimen from off Coogee the first antennæ have a primary flagellum of twenty-nine joints, a secondary of ten; in the second antennæ the flagellum is eleven-jointed. In one of the specimens from off Wollongong the same numbers were counted, but one of the upper antennæ had an eight-jointed accessory flagellum, the other a ten-jointed. Lenth of specimen 9 mm. Walker's specimen measured 5 mm.

There is a strange resemblance in the second gnathopods of this species to those of the female *Elasmopoides chevreuxi*, from

South Africa, described in 1908. The peculiarly-shaped large eyes and the strongly dentate hind margin in the last three pairs of peraeopods combine with other characters to make the last-named species quite distinct from Costa's.

Localities.—Off Coogee and off Wollongong, 55-56 fathoms. The distribution is hereby greatly extended.

MÆRA HAMIGERA (*Haswell*).

Station 57.

Mœra hamigera, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 333, pl. xxi., fig. 1, f, g, g^1.

Mœra hamigera, Haswell, Proc. Linn. Soc. N. S. Wales, xx., 1885, p. 104.

Mœra hamigera (part?), Stebbing, Das Tierreich, xxi., 1906, p. 437.

Mœra hamigera, Walker, Trans. Linn. Soc., xii., 1909, p. 335, pl. xliii., fig. 5, gn. 2, pl. 3.

The "Thetis" specimen of this species throws doubt upon the identification with *Megamoera suensis*, var., Haswell, proposed in "Das Tierreich." The variety in question is a large species, measuring with antennæ and third uropods about 32 mm. After deduction of those appendages, this would leave for the body, from front of head to end of telson, not more than 14 mm., and the length of *M. hamigera* was given originally at half-an-inch, or 12·5 mm., but it is not stated whether this measurement includes the antennæ and uropods. Without those extensions our specimen, apparently a well developed male, measures a little less than 5 mm.

In the second gnathopods Haswell found the left member a little larger than the first pair and of similar form, but the right member very large and of characteristic shape, and figures it with a blunt finger. The "Thetis" specimen has the finger of the larger gnathopod blunt, but it is the left member instead of the right, as described by Walker for his specimens from Suez and Khor Dongola, that from the former station having a length of 7 mm., with finger of its larger gnathopod, like that of the smaller one, acute.

The side-plates of the first peraeon segment deserve notice, having the somewhat convex lower margin produced forward in a little acute point, and the hinder extremity ending in a little forward pointing tooth.

In the "Thetis" specimen the first antennæ have the second oint longer and narrower than the first, but the third scarcely a

third as long as the second, instead of half its length as in Haswell's description. The flagellum is twenty-jointed, with a four-jointed accessory. The second antennæ have the penultimate joint of the peduncle the longest, the flagellum seven-jointed. The eyes are oval, of moderate size.

The third joint of the mandibular palp is a little shorter than the second. The inner plate of the first maxillæ has only three setæ, as stated by Walker.

In the first gnathopods the fifth joint is longer and rather broader than the sixth, in this respect differing from Haswell's figure, and also from the smaller member of the second gnathopods, in which the sixth joint is longer and not narrower than the fifth.

The last three peraeopods have the second joint more expanded above than below. The pleopods are very narrow. The first uropods have the rami nearly equal; they are only a little shorter than the peduncle. The rami of the second pair are unequal both in length and breadth. The rami of the third pair are longer than the peduncle, laminar, spinose, of equal length, differing a little in breadth.

The telson is scarcely longer than broad, the apices acute, wide apart though slightly convergent. Within and beyond each of these projects a long spine with an attendant spinule on its inner side. Adjacent to the spinules are the apical points of a round-ended cavity reaching about three-fifths of the telson's length, which at nearly this level carries a spine on each lateral margin, followed further down by two unequal setules.

A second specimen, presumably a younger male, from the same station, shows the second gnathopods not very unequal, the larger member of the pair having the fifth joint not short and cup-shaped, but much longer than broad.

Locality.—Off Wata Mooli, 54-59 fathoms.

Genus ELASMOPUS, *A. Costa.*

Elasmopus, Costa, Rend. Soc. Borbon., n.ser., ii., 1853, pp. 170, 175.

Elasmopus, Stebbing, Das Tierreich, xxi., 1906, pp. 441, 732.

Elasmopus, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 483.

Between 1901 and 1905 six species were added to this genus, one by Chevreux, one by Walker and A. Scott, and four by Walker, all mentioned but not described in "Das Tierreich." In 1908 Chevreux added the species *E. minimus* and *E. spinidactylus*.

ELASMOPUS SUBCARINATUS (*Haswell*).

Stations 28, 35, 37, 38, 48, 57.

Megamœra subcarinata, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 335, pl. xxi., fig. 4.

Elasmopus subcarinatus, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1019, *E. persetosus* on pl. 98.

Elasmopus subcarinatus, Stebbing, Das Tierreich, xxi., 1906, p. 441.

Localities.—Off Manning River; off Port Hacking; Botany Bay, 50 to 52 fathoms; off Wollongong, 55 to 56 fathoms; off Wata Mooli, 54-59 fathoms.

Family DEXAMINIDÆ.

Dexaminidæ, Stebbing, Chall. Rep., Zool., xxix., 1888, pp. 573, 900.

Dexaminidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 514, 735.

Dexaminidæ, Patience, Ann. Mag. Nat. Hist., (8), i., 1908, p. 117.

No new genera have recently been added to this family, but Mr. Patience has shown that *Dexamine dolichonyx*, Nebeski, instead of being made a synonym of *Tritæta gibbosa*, Bate, should really be regarded as a synonym of *Dexamine thea*, Boeck.

Genus PARADEXAMINE, *Stebbing*.

Paradexamine, Stebbing, Ann. Mag. Nat. Hist., (7), iv., 1899, p. 210.

Paradexamine, Chevreux, Bull. Soc. Zool. Fr., xx., 1906, p. 82.

Paradexamine, Stebbing, Das Tierreich, xxi., 1906, p. 518.

The original definition derived from a single species still holds, to cover the three species now included in the genus. Among themselves these may be distinguished as follows :—

1	Second joint of fifth peraeopod much expanded	1. *P. flindersi*, Stebbing.
	Second joint of fifth peraeopod not much expanded	2.
2	Rami of third uropod short, not reaching beyond the telson	2. *P. pacifica*, Thomson.
	Rami of third uropod long, reaching beyond the telson	3. *P. fissicauda*, Chevreux.

Dexamine serraticrus, A. O. Walker in Herdman's Rep. Ceylon Pearl Fish., ii., 1904, p. 265, pl. iv., fig. 24, appears to be a near

ally of *P. flindersi*, though differing in a few points, but the mouth organs are not described, thus leaving its generic position doubtful.

PARADEXAMINE FLINDERSI (*Stebbing*).

(Plate lii.)

Stations 35M, 57.

Dexamine flindersi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 146, pl. clxxxvii. c.
Guernea flindersi, Stebbing, Das Tierreich, xxi., 1906, p. 522.

More than twenty years ago a fragmentary specimen obtained by the "Challenger" Expedition from Flinders Passage, East Australia, was doubtfully referred to the genus *Dexamine*. Though the description and figures were necessarily incomplete, the species was thought worthy of a name, because, while making a close approach to the genus mentioned, it did not in all respects coincide with it. In 1906 it was transferred to the genus *Guernea*, but still with hesitation, as in the long interval no fresh material had come to hand. At length the "Thetis" collection has remedied this defect. But even now all the new specimens appear to be of the female sex, while, judging by the second antennæ, the original fragment is a male.

In describing the female of *Paradexamine fissicauda* from the Antarctic Ile Wandel, Monsieur Chevreux gives the following particulars :—sixth and seventh segments of the peraeon carrying a medio-dorsal carina, ending in a little tooth, first three segments of pleon with a similar carina ending in a strong tooth, flanked on either side by another tooth, fourth segment with the median carina forming a tooth larger than the preceding, the coalesced fifth and sixth segments carrying two groups of dorsal spines ; head almost as long as the first three segments of the peraeon taken together, armed with a little sharp rostrum, lateral lobes not very salient ; first four pairs of side-plates almost of the same height as the segments which carry them ; postero-lateral angles of the second and third pleon segments produced sharply backward. All these particulars apply equally to the present species, which is only one-fifth as long as *P. fissicauda*, and differs from it in being much compressed, with the integument not specially thick or rigid. The side-plates are all more or less denticulate, and so are the postero-lateral margins of the first three pleon segments.

Eyes with very numerous components, pale in spirit.

First antennæ with first joint thicker and longer than the second, which has an apical tooth not always very obvious, and is

about two-and-a-half times longer than the third. This last differs little in appearance from the neighbouring joints of the flagellum, which are in all about ten in number, slender, with filaments on the apical joint. In the male the second joint of the peduncle is of the same shape as in the female, but longer than the first joint. The second antennæ, shorter than the first, have the peduncle as in the male, but the flagellum seemingly consisting of a single conical joint, but perhaps three-jointed, slightly shorter than the last joint of the peduncle. The antennæ of *P. fissicauda* show several differences, and have in the first pair a flagellum of eighty-five joints and one of fifty in the second.

The upper lip has no emargination of the convex distal border. The lower lip agrees with *P. pacifica* and *P. fissicauda* in having well-developed inner plates and the apices of the mandibular processes upturned. The small, undoubtedly one-jointed palp of the first maxillæ has apically three setæ. The inner plate of the second maxillæ is much shorter than the outer, both apparently with scanty armature. The inner plates of the maxillipeds are well-developed, though very short, carrying spines and perhaps spine-teeth on their truncate apices. The representation of these in the "Challenger" Report must be regarded with suspicion, as indeed is intimated in the text.

Both pairs of gnathopods have the sixth joint distally truncate with the transverse palm in the first pair quite straight, and in the narrower second scarcely convex, and only very slightly oblique, forming less than a right angle with the hind margin, not more, as in the other two species.

In all the peraeopods, except the fifth pair, the fourth joint is longer than the fifth, but in the fifth pair, which is shorter than either of the two preceding pairs, this proportion is reversed. The second joint is oblong in the third, pear-shaped in the fourth, and rotundo-quadrate in the fifth pair, its front margin in this last being nearly straight, but the hind margin very much rounded and more strongly serrate than in the other two pairs. In the specimens examined the branchial vesicles were narrow.

The pleopods are of no great strength. The other appendages may be described in Monsieur Chevreux' terms as applied to his *P. fissicauda*. First uropods elongate, branches longer than the peduncle; second pair very short, inner branch longer than the outer; third pair reaching the level of the extremity of the first pair, branches lanceolate, much longer than the peduncle, and edged with small spines. Telson much longer than the peduncle of the third uropods and cleft to the base. It is a question whether in our species the second uropods should be called *very*

short, but the figures of the two species show that the relative proportions are the same in both. The telson in the present species has each apex divided with a simple outer tooth and a slightly shorter inner bifid one, a setule separating them. Mr. Walker's *serraticrus* has the apices differently arranged. Length, from head to end of telson, about 3 mm.

Localities.—Off Port Hacking, and off Wata Mooli, 54-59 fathoms.

Family AORIDÆ.

Aoridæ, Stebbing, Ann. Mag. Nat. Hist., (7), iv., 1899, p. 211.
Aoridæ, Stebbing, Das Tierreich, xxi., 1906, pp. 585, 736.
Aoridæ, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, pp. 510, 515.

To the seven genera defined in "Das Tierreich" as belonging to this family, Dr. Norman in 1905 added *Coremapus* for the species previously known as *Microdeutopus versiculatus* (Bate). On the other hand, investigation of the "Thetis" Amphipoda has led to the transfer of the genus *Dryopoides* to the Corophiidæ, but M. Chevreux, by an opportunity of examining the mouth-organs in a new species of *Xenocheira*, finds that that genus ought to be transferred from the Photidæ to the Aoridæ. The new genus *Paraoroides* is exceptional in this family by having the third uropods one-branched.

Genus LEMBOS, *Bate.*

Lembos (part), Bate, Ann. Mag. Nat. Hist., (2), xix., 1857, p.142.
Lembos, Stebbing, Das Tierreich, xxi., 1906, pp. 594, 737.
Lembos, Walker, Trans. Linn. Soc., xxii., 1909, p. 337.

Nine species of this genus are described in "Das Tierreich," to which the appendix adds mention of *L. smithi*, Holmes, 1903, *L. podoceroides*, Walker, 1904, and *L. chelatus*, Walker, of the same date. To these must be added *L. leptocheirus*, Walker, 1909, from Wasin and Suez, a species in which the second gnathopod of the male closely resembles that of *Coremapus versiculatus*, while the first gnathopods are quite distinct.

LEMBOS PHILACANTHUS (*Stebbing*).

Stations 35, 57.

Autonoe philacantha, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1082, pl. cx.
Lembos philacanthus, Stebbing, Das Tierreich, xxi., 1906, p. 598, fig. 102.

Some slight differences between the male specimen obtained by the "Thetis" and that taken in Bass Strait by the "Challenger" require notice. The upper lip has a more strongly rounded margin. The spine-row of the mandible has only seven spines. The second gnathopods have the sixth joint not at all widened distally as represented in my figure of the "Challenger" specimen, although that widening is not mentioned in the text. In the third uropods the rami are as nearly as possible equal in length, and the telson shows only two instead of five setiform spines at each subapical corner.

In the female the first gnathopods, though larger than the second, are not very bulky. The sixth joint, a little longer than the fifth but not broader, is narrowly oval, having the palm defined from the hind margin by a palmar spine. In the second gnathopods the sixth joint is slightly longer than the fifth, the palm a little oblique, but much shorter than the hind margin, with which it forms an angle. The specimen examined carried nine large eggs in the marsupium.

Localities.—Off Port Hacking, and off Wata Mooli, 54-59 fathoms.

Genus PARAOROIDES, *gen.nov.*

First antennæ with accessory flagellum minute, rudimentary. Border of upper lip rounded, not emarginate. Principal lobes of lower lip wide apart. Mandibular palp, third joint the longest, slender, setose only at distal end. Gnathopods as in *Lembos*, but only moderately setose. Third, fourth and fifth peraeopods with second joint broadly expanded, finger short, curved, reverted. Third uropods short, and, unlike other members of the family, with only one ramus.

The generic name refers to some points of agreement which this genus shows with *Aoroides*, A. O. Walker. That genus, however, is described as entirely devoid of an accessory flagellum, and has biramous third uropods. The latter character belongs likewise to *Lembos*, which in addition has the accessory flagellum well developed.

PARAOROIDES UNISTILUS, *sp.nov.*

(Plate liii.)

Station 28.

The first segment of the peraeon is longer than the second, with side-plates produced forward, but not acute.

The eyes are small. In the first antennæ the first joint is longer and much stouter than the second, the third in the adult

male about half as long as the second, with flagellum of nine joints; in the other specimen the third joint is scarcely more than a third of the second, with flagellum of six joints. The accessory flagellum is microscopic, a tubercle tipped with several setules. The second antennæ have the gland-cone acute, the third joint stout, the fourth stouter and a little longer than the fifth, which a little exceeds the four-jointed flagellum, armed on each of these joints with a pair of curved spines.

The lower lip has a peculiar appearance by the wide display of the inner lobes between the rather narrow principal lobes. The mandibular processes are narrow, curved.

The mandibles have the cutting edge and accessory plate not much divided, the latter less strong on one mandible than on the other; spine-row of three or four spines; molar strong; curved second joint of palp about twice as long as first, with a single spine on the margin; third joint as long as first and second united.

First maxillæ with inner plate seemingly unarmed, outer plate with short spines, second joint of palp elongate. Second maxillæ with inner margin of inner plate fringed. Maxillipeds with three spine-teeth on truncate distal margin of inner plate; outer plate reaching end of second joint of palp, its inner margin fringed with eight spine-teeth, followed by some graduated spines on distal border.

First gnathopods of adult male with fifth and sixth joints robust, subequal in breadth and length, the sixth having a palmar spine at apex of hind margin, flanked by a conical tooth from the base of which the palm slopes to the broadly truncate hinge margin carrying the curved finger. Inner margin of finger with small decurrent tooth, its apex with small unguis. The (supposed) female has the side-plate much more narrowly produced forward, the fifth and sixth joints of the limb narrow, the fifth rather the longer, in the sixth joint the short piece between the palmar spine and the hinge margin almost continuous with the hind margin. The setose furniture of the gnathopods of both pairs in both (presumed) sexes is alike.

Second gnathopods of adult male with fifth joint longer than sixth, both less broad than those of the first pair, but subequal in combined length, short palm of sixth joint curving over to hinge margin. In the (supposed) female these two joints are much narrower than those of the male and are also narrower than those of their own first gnathopods.

The first and second peraeopods are alike, the fifth joint narrower than the fourth, the sixth than the fifth, the finger nearly straight. The hind margin of the sixth is armed with four

stiff setæ, of which the third is the longest. The third, fourth, and fifth peraeopods are successively longer, the increase depending chiefly on the fifth and sixth joints. In all three pairs the second joint is broadly expanded, with the hind margin setose, the last four joints are reverted, and the short finger is uncinate. In the third and fourth pairs there are moderately strong spines on the front (by reversion the hind) margin of the sixth joint. In the fifth pair the spines are minute.

The pleopods have two small coupling-hooks. The rami are unequal, not very numerously-jointed.

The first uropods have a long spine-process at apex of the peduncle. The rami are rather longer than the peduncle, subequal, with several spines on the margin. The second uropods are similar, on a smaller scale. The third uropods have a short peduncle, which is both stouter and longer than the single ramus, which terminates in several setæ, among which may be discerned a tubercular microscopic second joint.

The telson is simple, about as long as broad, surmounted by a submedian pair of setules, and having a little prominence on either side of the rounded apical border. Length of adult, from front of head to end of seventh peraeon segment, 3·75 mm.

The specific name alludes to the peculiarity for a member of the Aoridæ that the third uropods have but one ramus.

Locality.—Off Manning River. Two specimens, of which one is obviously an adult male, the other is probably a female with the marsupial plates undeveloped.

Family PHOTIDÆ.

Photidæ, Boeck, Skand. Arkt. Amphip., i., 1872, p. 74; ii., 1876, p. 546.

Photidæ, Walker, Herdman's Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 234.

Photidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 603, 737.

Photidæ, Walker, Nat. Antarctic Exp., iii., 1907, pp. 5, 35.

Genus PHOTIS, *Kröyer.*

Photis, Kröyer, Naturh. Tidsskrift, iv., 1842, p. 155.

Photis, Walker, Herdman's Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 286.

Photis, Stebbing, Das Tierreich, xxi., 1906, pp. 605, 738.

In 1904, Mr. A. O. Walker added to this genus the new species *P. longimanus* from Ceylon waters, and from the same region

named a new species *P. nana*, with the not unneeded warning that this form, known only in the female, would probably have to be referred to a new genus. At the same time he suggested that *P. reinhardi*, Kröyer, might perhaps be allowed to include *P. tenuicornis*, Sars, *P. pollex*, Walker, and *P. longicaudatus* (Bate). The elongated eye-lobes of the last-named species seem to make its identification with *P. reinhardi* very doubtful, while they bring it into proximity with the Australian species about to be described.

PHOTIS DOLICHOMMATA, *sp.nov.*

(Plate lvb.)

Stations 28, 35, 37, 44, 48, 49, 57.

This abundant species appears to exceed all other known members of the genus in the prolongation of the apically rounded eye-lobes, in the size attained by the eyes, the more numerously jointed flagella of the antennæ, the setose furniture of the limbs, and to have characteristic third uropods, in that the second joint of the outer branch is unusually small and the inner branch is rather longer than usual. The second gnathopods also have a distinguishing outline to the palm.

Though the eye-lobes are always prolonged and round-ended, the dark eyes themselves are variable in size and shape, passing from round to oval in their fullest development.

In the first antennæ the second joint is much the longest, the third joint is not shorter than the stouter first and has a scarcely perceptible rudiment of an accessory flagellum. The principal flagellum may have as many as fourteen joints. The flagellum of the second antennæ appears to vary between six and thirteen joints. Both pairs carry numerous and very long setæ.

In the mouth-organs I have not observed any distinguishing features. The mandibles show eight spines in the spine-row, and in the palp the second and third joints are subequal.

The first gnathopods have the rounded lower corner of the side-plates produced forward, its lower margin as in the four following pairs fringed with long setæ. The fifth joint is subequal in length to the sixth but a little narrower; both joints are very setose. The palm is oblique, but not excavate, forming an obtuse angle with the hind margin. The curved finger has the middle part of the inner margin finely serrate, and the whole limb is in near agreement with that of *P. longicaudatus*, Bate. The second gnathopods differ from those of the latter species as figured by Sars, and still more from the Indian form figured by Walker. The decurrent lobe of the second joint represented by

Sars is entirely wanting, the palm is less oblique and defined by a moderately strong tooth with adjacent spine. Between this and the finger hinge are two small processes separating shallow excavations.

The peraeopods are of the character usual in the genus, but the side-plates of the third pair seem to differ by having the width (true length) of the deep front lobe much less than usual relatively to that of the hind lobe. The second joint of the third peraeopods is nearly circular and strongly fringed with setæ on both margins. The backward-turned finger is as usual opposed to a strong spine projecting from the preceding joint and carries behind its nail a spine so strong as to give the finger an appearance of being apically bifid. The same structure, however, is repeated in the two following pairs, but on a scale successively so dwindled that the little spines might easily pass unobserved. As in other species the fourth pair are longer than the third and the fifth than the fourth, with the breadth of the second joint in comparison with its length successively diminishing.

The pleopods have very small coupling spines. The inner ramus is rather longer than the outer, though it has one joint less, the number of joints being respectively nine and ten, as counted in one pair.

In all the uropods the peduncle is longer than the rami, especially so in the first pair. As already noticed the second joint of the outer ramus in the third uropods is very diminutive, the inner ramus is about one-third as long as the outer. The telson is small, triangular, rather broader than long, with the customary spinule and setule springing from the surface a little above and on each side of the apex. Length at full stretch about 7·5 mm. from apex of eye to apex of telson; first antennæ attaining a length of 6 mm.

The specific name, from δολιχός, long, and ὄμματα, eyes, refers to those features as described.

Localities.—Off Manning River; off Port Hacking; Botany Bay, at a depth of 50-52 fathoms; off Coogee; off Wollongong, at 55-56 fathoms; off Port Kembla, and off Wata Mooli, at 54-59 fathoms.

Genus CHEIRIPHOTIS, *A. O. Walker.*

Cheiriphotis, Walker, Herdman's Rep. Ceylon Pearl Oyster Fish., ii., 1904, pp. 234, 283.

Cheiriphotis, Stebbing, Das Tierreich, xxi., 1906, p. 737.

Walker's diagnosis of the genus (not given in "Das Tierreich") is as follows:—"Body very slender, scarcely compressed laterally;

side-plates very small. Head slightly produced in front, ocular lobes more so, angular or cuspidate. Upper and lower antennæ subequal, the latter stronger; appendage well-developed. Mandibles with the palp long, second and third joints subequal, the whole as in *Gammaropsis* [Eurystheus].

"Second gnathopods of moderate size in the female, but immensely developed and peculiarly formed in the male; urus [pleon from 4th segment] small; the third uropods with the outer ramus very short, without a terminal joint, and the inner rudimentary.

"This genus is nearly allied to *Microprotopus*, from which it differs chiefly in the smallness of the side-plates."

The only trustworthy distinction between *Microprotopus*, Norman, and the present genus seems to depend on the last-named character, since the excessively minute rudiment of an inner ramus to the third uropod is not improbably present also in *Microprotopus*. The new species now to be added to *Cheiriphotis* has normal lateral compression, the second gnathopods in the male strongly, but not immensely, developed, with the fifth joint small but quite distinct. These are differences from the species *Melita megacheles*, Giles, for which the genus *Cheiriphotis* was founded, yet neither singly nor together would they seem to justify further generic division.

Second gnathopods of adult male with wrist and hand coalescent, and palm transverse..... 1. *C. megacheles* (Giles).
Second gnathopods of adult male with wrist and hand distinct, and palm deeply excavate 2. *C. australiæ*, sp.nov.

CHEIRIPHOTIS AUSTRALIÆ, *sp.nov.*

(Plate liv.).

Stations 28, 50.

Body laterally compressed. Head as long as first two segments of peraeon combined, ocular lobe obtusely pointed. Hind segments of peraeon and first three of pleon respectively, longer than those which precede and follow them. Third pleon segment with blunt postero-lateral angle forming a little crenulation more distinct in male than in female.

Eyes not perceived, probably owing to the condition of the specimens.

First antennæ with first two joints subequally long, third less than half as long as second, flagellum eleven- to thirteen-jointed, accessory flagellum three- to four-jointed, not including rudimentary apical joint.

Second antennæ slightly longer and in both sexes considerably stouter than first, but especially in the male; fifth joint of peduncle subequal in length to the fourth, each as long as, or longer, than the flagellum, which has from five to seven joints, the first always the largest, sometimes very much so in the male, where the three or four terminal joints may be abruptly narrower than the preceding.

Upper lip bilobed. Third joint of mandibular palp as long as second, distally setose. Inner plate of first maxillæ oval with setule on the almost pointed apex, and four spaced setæ on the inner margin at a little distance from the apex. Inner plate of second maxillæ rather the smaller, with lateral setæ. Inner plates of maxillipeds reaching beyond first joint of palp, outer reaching nearly to end of the long second joint; fourth joint of palp short, with small spine or unguis attached to its truncate apex.

First gnathopods much alike in the two sexes, the fifth joint rather longer than the sixth, these two joints like the side-plates being rather larger in the female than in the male. The palm of the somewhat filiform sixth joint is longer than the hind margin, and is matched in the male and overlapped in the female by the curved finger.

The second gnathopods are much more powerful in the male and differently shaped from those of the female. The fifth joint in both is short, cup-shaped with a narrowed lobe between the fourth and sixth joints. The latter in the male has a breadth fully four-fifths of the length, with the hind margin produced into a powerful tooth, against which the unguis of the strongly arched finger impinges, enclosing a great cavity with another strong tooth at its distal extremity near the hinge of the finger. The much smaller sixth joint in the female has a breadth two-thirds of the length and a sloping sinuous palm, over which the finger closes, leaving only one or two shallow cavities.

The peraeopods are in near agreement with those of *C. megacheles*. In the first and second pairs the second and fourth joints are somewhat expanded. In the three following pairs the second joint is much expanded, the breadth being equal to the length in the third pair, but exceeded by it in the other two. The third pair is the shortest, the fifth the longest. In the male specimen figured the terminal joints of all three pairs were reversed, but apparently as a rule this is more the habit of the third than of the other two pairs.

In the first uropods the peduncle is considerably, in the second a little, longer than the rami, which in each pair are subequal. In the third uropods the peduncle is as broad as it is long. The

outer ramus is a little shorter and less than half the breadth, distally armed with seta-like spines, successively longer, and a stout spine with a smaller companion on each side. The inner ramus is a rudiment not half the breadth and only a quarter the length of the outer, with a little spine on its truncate end.

The telson is small, broader than long, with the distal border slightly angled between two sets, consisting each of a spinule and setule which project from the dorsal surface. Length of the animal, not including antennæ, about 3 mm.

The specific name speaks for itself.

Locality.—Off Manning River, one specimen; from Jarvis Bay, specimens of both sexes numerous, but all with the appearance of having at some time been partially dried.

Genus EURYSTHEUS, *Bate.*

Eurystheus, Bate, Ann. Mag. Nat. Hist., (2), xix., 1857, p, 143.
Gammaropsis, Walker, Ann. Mag. Nat. Hist., (7), xviii., 1906, p. 153.
Eurystheus, Stebbing, Das Tierreich, xxi., 1906, pp. 610, 637, 638.
Eurystheus, Stebbing, Ann. S. African Mus., vi., 1, Crust., 4, 1908, p. 84.
Eurystheus, Holmes, Proc. U.S. Nat. Mus., xxxv., 1908, p. 541.
Eurystheus, Walker, Trans. Linn. Soc., xii., 4, 1909, p. 339.

It may here be explained that the reason for rejecting Liljeborg's *Gammaropsis* in favour of Bate's later name *Eurystheus* depends on the circumstance that Liljeborg included in his genus a species identical with the single form for which Kröyer's *Protomedeia* was established. Thus *Gammaropsis* became at once a synonym of *Protomedeia*. From the thirteen species described in "Das Tierreich" as belonging to *Eurystheus*, one, *E. hirsutus*, has since been transferred to *Cheiriphotis*, Walker, as the female of *C. megacheles* (Giles). Four species are mentioned without description, namely, *E. dentatus*, Chevreux, 1900, *E. tenuicornis*, S. J. Holmes, 1904, *E. zeylanicus*, A. O. Walker, 1904, *E. gardineri*, Walker, 1905. To these must now be added *E. longicornis*, Walker, 1906, *E. holmesi*, Stebbing, 1908, *E. dentatus*, Holmes, 1908, and *E. monuropus*, Walker, 1909. But of these species the last but one has, it will be perceived, a preoccupied name. Like Chevreux's species it has certain segments of the pleon dorsally dentate. In other respects it differs considerably, having the first gnathopods compact instead of slender, and the third uropods short instead of comparatively long. It may be distinguished as *E. alaskensis*, from its place of origin.

EURYSTHEUS ATLANTICUS (*Stebbing*).

Stations 28, 35, 37, 44, 57.

Gammaropsis atlantica, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1101, pl. cxiv.

Eurystheus atlanticus, Stebbing, Das Tierreich, xxi., 1906, p.611.

Eurystheus atlanticus, Stebbing, Ann. S. African Mus., vi., Crust., 4, 1908, p. 86, pl. xlb.

This small, widely distributed species is distinguished by its lageniform eyes. In the second gnathopods the hind margin of the sixth joint is flat and long, especially in the male, which has the defining tooth of the palm stronger than that of the female. In the Australian form, from Station 44, the oblique palm of the male differs to a slight extent from that which I have figured for the South African form, the part near the finger hinge being divided into three triangular teeth. In the general shape of the hand, the cavity occupied by a palmar spine, and in the rather short massive finger, the two forms are in agreement. But the Australian variety exhibits in the male, not in the female, a fringing of very long setæ on the front border of the hand, and also of the second joint. Such furniture, however, is probably of an easily detachable character. A specimen from Station 57 has second gnathopods agreeing closely with the African form, the hand very powerful, yet with a more slender finger, which has a slight projection of its inner margin near the hinge. Length about 7 mm.

Localities.—Manning River; off Port Hacking; Botany Bay, 50-52 fathoms; off Coogee, and off Wata Mooli, 54-59 fathoms.

EURYSTHEUS THOMSONI (*Stebbing*).

Stations 37, 57.

Gammaropsis thomsoni, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1103, pl. cxv.

Eurystheus thomsoni, Stebbing, Das Tierreich, xxi., 1906, p. 613, fig. 106.

The present species was originally described from a single specimen, a female, taken by the "Challenger" Expedition off New Zealand. The male has now come to light. It was the only one of the specimens carrying an unbroken upper antenna, which showed a secondary flagellum of the character usual in the genus. Over anxiety to secure this in a preparation mounted for the microscope resulted in its mysterious disappearance. The

two sexes are in close agreement, except in regard to the second gnathopods. These are much larger in the male, with the palm of the sixth joint less oblique, and defined by a decided tooth, the palm between this and the finger hinge being crenulate with a cavity in the middle. The border of the cavity on the hinge side rises to a little tooth, from which the crenulation is continued without slope. The stout finger impinges against the palmar tooth, and has a minute prominence on its inner border, touching the tip of the hind border of the palmar cavity.

The fourth and fifth peraeopods are stouter in the male than in the female. In both sexes the telson has a minute point at the centre of the apical border.

I have already called attention to the similarity of the second gnathopod in the male of *Mœra inœquipes* and the female of *Elasmopoides chevreuxi*. The present species offers another instance of the same singular resemblance, the hand and finger of the male being so like in structure to those found in the different sexes of the other two species, that one might readily accept them as all belonging to a single species, did not other considerations forbid it. They pertain in fact to three distinct genera. As already mentioned, the specimen of *Mœra inœquipes* in the present collection has a true pair of second gnathopods, both members of the pair being equally developed, as if to flout the specific name. But the male of *Eurystheus thomsoni* in the "Thetis" collection has only one member of this pair finely developed, the other being less developed than in the female, the hand forming a narrow oval with no well-marked palm. The same inequality of the second gnathopods is noted by Professor Haswell in *Mœra crassipes*, which I have ventured to transfer to the present genus. If my classification of it is right, it stands very near to the present species, being chiefly distinguished from it by the different structure of the second gnathopods.

It will no doubt be remembered that, where the second gnathopods attain to considerable bulk, it is not uncommon to find a great disparity between the two members of a pair.

Localities.—Botany Bay, 50-52 fathoms. An imperfect specimen, a female, was obtained off Wata Mooli at 54-59 fathoms depth.

Family AMPITHOIDÆ.

Ampithoidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 631, 738.
Amphithoidæ, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 515.
Amphithoidæ, Walker, Trans. Linn. Soc., xii., 1909, pp. 326, 341.

Six genera of this family are defined in "Das Tierreich," to which should have been added *Paragrubia*, Chevreux, 1901, as mentioned in the appendix.

Genus AMPITHOE, *Leach.*

Ampithöe, Leach, Edinb. Encycl., vii., 1813, pp. 403, 432.
Ampithoe, Stebbing, Das Tierreich, xxi., 1906, pp. 631, 738.

AMPITHOE FLINDERSI, *Stebbing.*

Station 57.

Amphithoe flindersi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1120, pl. cxviii.
Ampithoe flindersi, Stebbing, Das Tierreich, xxi., 1906, p. 635, fig. 108.

For this small species the collection did not supply the missing information in regard to the antennæ. The second gnathopods differ from those of the specimen originally described by having an excavation of the palm at right angles to the hind margin of the sixth joint, probably indicative of male maturity.

Locality.—Off Wata Mooli, 54 to 59 fathoms.

Family COROPHIIDÆ.

Corophidæ, Dana, Amer. Journ. Sci., (2), viii., 1849, p. 139.
Corophiidæ, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1154.
Corophiidæ, Stebbing, Das Tierreich, xxi., 1906, pp. 662, 739.

To the eleven genera of this family defined in "Das Tierreich," the genus *Grandidierella*, Coutière, 1904, was added by name in the appendix, and in the present report the genus *Dryopoides* is transferred from the Aoridæ to this family. Recently a second species of *Grandidierella* has been described by myself, three new species of *Corophium* have been described by Chevreux, and Stimpson's species *Corophium spinicorne* and *Corophium salmonis* have had much needed light thrown upon them by J. C. Bradley.

Genus CERAPUS, *Say.*

Cerapus, Say, Journ. Acad. Nat. Sci. Phil., xi., 1817, p. 49.
Cerapus, Stebbing, Das Tierreich, xxi., 1906, pp. 665, 740.

CERAPUS ABDITUS, *Templeton.*

(Plate lvA.)

Stations 13, 37.

Cerapus abditus, Templeton, Trans. Ent. Soc., i., 1836, p. 188, pl. xx., figs. 5*a-k* ♂.

Cyrtophium calamicola, Giles, Journ. Asiat. Soc. Bengal, liv., 1885, pt. 2, p. 54, pl. i. ♂.

Cerapus calamicola, Stebbing, Chall. Rep., Zool., xxix., 1888. p. 563 ♂.

Cerapus flindersi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1163, pl. cxxv. ♀.

Cerapus flindersi, Chilton, Rec. Austr. Mus., ii., 1892, p. 1, pl. i. ♂ and ♀.

Cerapus calamicola, A. O. Walker, in Herdman, Rep. Ceylon Pearl Oyster Fish., ii., 1904, p. 293.

Cerapus calamicola, Stebbing, Das Tierreich, xxi., 1906, p. 740.

When the figures of the second gnathopod in the male, as given by Templeton, are compared with those drawn by Chilton from specimens collected at Port Jackson, and these again with Dr. Giles' drawing from an Indian specimen, and the illustration here offered from a Botany Bay example, the conclusion will seem justified that, unless there are other characters of distinction, all these variations belong to a single species. Mr. A. O. Walker is so convinced of the identity of *C. calamicola* and *C. flindersi* that he unites them without discussion. Yet in the former a deep rounded cavity is represented between the two distal teeth of the fifth joint, which does not appear in any of the other figures. This, however, is less strange than the two equal parallel-sided processes which Dr. Chilton found in one of his male specimens in place of the usual dentiform prolongations. In the specimen here figured the fifth joint agrees with the abnormal form just mentioned in having the fifth joint much elongated, and the sixth much curved, but it approaches *C. calamicola* in having the outer process greatly larger than the inner, which is here quite minute, opposable to a little process on the inner margin of the sixth joint near the base, a peculiarity not noticed elsewhere.

The first antennæ have the first joint much deeper than the others, the basal half forming a little sharp projection distally; the second joint is longer than the first and about three-fourths as long as the third; the eight-jointed flagellum is longer than the last joint of the peduncle, and fringed with numerous sensory filaments. The second antennæ are rather longer than the first and reach very nearly as far; the last joint of the peduncle is nearly as long as the six- or seven-jointed flagellum, of which the first joint is nearly as long as the next five, each of the latter having a small apical spine.

The male specimen, taken from a tube 13 mm. long, measured from front of head to fold of pleon 5 mm., the antennæ projecting about another 6 mm.

From a tube 18 mm. long a female was taken, measuring 6·75 mm. from rostrum to end of peraeon, the first antennæ with nine-jointed flagellum, 4·25 mm. long. This specimen had a very pointed rostrum and a faint carina along the middle of head and body. To the tube were attached nine small tubes of about 3 mm. length. This tube and some others were coated with fine grains of sand, but there were some quite smooth.

Localities.—Off Cape Three Points, 41 to 50 fathoms, tubes perhaps empty; Botany Bay, from depth of 50-52 fathoms.

Genus SIPHONŒCETES, *Kröyer.*

Siphonœcetes, Kröyer, Naturhist. Tidsskrift, (2), i., 1845, pp. 481, 491.

Siphonœcetes, Stebbing, Das Tierreich, xxi., 1906, pp. 681, 740.

The known species of this genus make so near an approach one to the other, that Professor Della Valle in 1893 was contented with Kröyer's *S. typicus* as a common name for the three northern species, together with a form found in the Mediterranean. Mr. A. O. Walker, after describing *S. orientalis*, sp.nov., in 1904, from the Indian Ocean, observes:—"The narrowness of the hands of the gnathopods distinguishes this species from the others, but I confess that I am inclined to agree with Della Valle[11] (Gamm. d. Golfo di Napoli, p. 362) that the points of difference between *S. typicus*, Kröyer, the original Arctic species, *S. colletti*, Boeck, and *S. pallidus*, Sars, are not greater than can be accounted for by age, &c., so that both these species, as well as the present one, might well be united to *S. typicus*."[12] This is a comfortable doctrine, indicating that one section of the scientific world is growing weary of new species although at the same time another section is eager to name sub-species, varieties, and subvarieties. From Australian waters I am venturing to describe a form which seems to me independent, having a blunt rostrum, the ultimate joint of peduncle in the large second antennæ longer than the penultimate, and the ramus of the third uropods not longer than broad. In this respect it agrees only with *S. sabatieri*, Rouville, 1894, from which, however, it is distinguished by the first uropods, and with *S. smithianus*, Rathbun, 1905 (a new name for S. I. Smith's preoccupied *S. cuspidatus*, 1873), in which the rostrum is long, slender, acute, and the last joint of peduncle in the second antennæ decidedly shorter than the preceding joint. It may be noticed that in *S. orientalis*, Walker, the flagellum of the first antennæ is fourteen-

[11] Della Valle—Fauna Flora Neapel, xx., 1893.
[12] Walker—Rep. Ceylon Pearl Oyster Fish., il., 1904, p. 294.

jointed, whereas in no other species have more than seven joints been assigned to that appendage.

SIPHONŒCETES AUSTRALIS, *sp.nov.*

(Plate lvi.).

Stations 13, 37.

Animal, as extracted from its *Dentalium* habitation, straight as far as the last peraeon segment, with which the curvature commences for the close ventral infolding of the terminal pleon segments. Head longer than any segment of the peraeon, produced with a rounded process rather than a rostrum between the projecting eye-lobes.

Eyes small, dark in preserved specimens, with very few components. First antennæ about as long as head and peraeon combined, first joint a little longer than third but shorter than second, which is almost as long as the six-jointed flagellum. In this the sixth joint is minute, and the first notably shorter than any of the four following joints. In the second antennæ the first two joints are short. The three following have the relative proportions, 10, 24, 29, the last two together equalling the length of the first antennæ. In the same proportion the three-jointed flagellum would be represented by the number 12; it has none of the uncinate spines found on the lateral margins in *S. orientalis*, but one apical curved spine on the second joint and two such spines on the third; a female specimen has first antennæ reaching end of peduncle of second antennæ.

In the mouth-organs no distinctive character was observed apart from those assigned to the genus, in which the one-jointed palp of the mandible is most exceptional.

The first gnathopods have the side-plate somewhat quadrate with acute front angle, the fifth joint a little shorter but broader than the sixth, which has a very oblique palm scarcely distinct from the hind margin except by a large defining spine followed by two others successively smaller; the curved finger has nine little teeth on the inner margin, the largest near to the nail.

The second gnathopods have the front corner of the side-plate rounded. The triangular fifth joint is distally as broad as the joint is long, the sixth joint is scarcely so long as that of the first pair but broader, the palm defined by a long spine, which is succeeded by four others successively smaller along the crenulate hind margin. The curved finger has about six little teeth on its concave margin.

The peraeopods are scarcely distinguishable from those of *S. colletti*, Boeck. In the first and second pairs the much expanded

second joint shows the largely developed gland, the secretion from which no doubt issues through the straight finger for cementing purposes, whether in lining the interior of the inhabited shell or in attaching sand-grains to the shell's mouth. The fourth joint is also much expanded, its widened distal end overlapping on both sides the little fifth joint. In the third and fourth peraeopods the second and fourth joints are less expanded than in the two preceding pairs, and the fourth joint does not clasp the fifth. The finger also is much smaller, and not straight, but curved back upon the hand. The fifth pair are more normal than the rest, but the not very broadly expanded second joint is fringed on both margins with plumose setæ. The remainder of the limb is linear, the sixth joint being the longest and notably curved, this and the small bidentate finger not facing forward like the rest of the limb, but backward, as shown in Kröyer's figure of *S. typicus*, but not so figured or described by either Boeck or Sars for their species.

On the widely expanded peduncles of the pleopods there are two very slender coupling spines, each armed on each side with three backward-directed denticles.

The uropods *in situ*, when the animal was withdrawn from the shell, were closely folded upon one another below and behind the telson, the rami of the first pair being at right angles to their peduncles, which are not on the upper side very greatly longer than the outer ramus. In the second pair the peduncles are much shorter, but here as in the first pair they are produced below the rami into a rounded lobe, which appears to be microscopically serrate. The minute quadrate single ramus of the third uropods carries two long setæ and one or two short ones. The peduncle is rather narrowly produced inwards, and has the remains or traces of three or four setæ. In the nearly allied *Concholestes dentalii*, Giles, the peduncle is entirely bereft of rami.

The telson is transversely oval, with a pair of minutely denticulate tracts on the distal margin. Length of dissected specimen from front of head to end of peraeon, 3 mm. A female specimen, containing two dark-brown eggs, was of similar dimensions, except, as above mentioned, that the first antennæ were relatively rather longer; on these and the second pair it retained traces of orange and white bands.

Localities.—Off Cape Three Points, 41 to 50 fathoms; and Botany Bay, from a depth of 50 to 52 fathoms.

Genus DRYOPOIDES, *Stebbing*.

Dryopoides, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1145.
Dryopoides, Stebbing, Das Tierreich, xxi., 1906, p. 601.

It may be convenient to observe that the reference to M. Bonnier's remarks on this genus in the Bull. Sci. France-Belgique, xx., which is given in "Das Tierreich" as p. 391, is in the separate copy, p. 247.

The discovery that the male sex in this genus has the second gnathopods very decidedly larger than the first, although in the female they are smaller, makes it desirable to transfer the genus from the Aoridæ, in which I placed it in 1906, to the Corophiidæ. In that family it may stand near to Say's *Unciola*, from which it is clearly distinguished by the two free rami of the third uropods.

DRYOPOIDES WESTWOODI, *Stebbing.*

(Plate lvii.A.)

Stations 28, 35M, 57.

Dryopoides westwoodi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1146, pl. cxxii.

Dryopoides westwoodi, Stebbing, Das Tierreich, xxi., 1906, p.601.

Except that the first antennæ are broken after the first joint and the second after the third, a female specimen obtained by the "Thetis" at Station 28 is in complete agreement with that figured from the "Challenger" collection. It contained a few young ones with their appendages well developed. As sometimes happens in various species, it showed the gnathopods rather larger on one side of the body than on the other. A female specimen from Station 57 has the antennæ in good condition, the upper pair with twenty-four joints to the flagellum, the lower with six. In a male from the same station there were twenty-two joints to the flagellum of the upper antennæ.

In the other male specimens the antennæ were defective. In most characters they show so exact an agreement with the females that there can be no reasonable doubt of their being partners. The sexual variation, however, is rather remarkable. It affects not only the first and second gnathopods, but also to some extent the first and second peraeopods.

The first gnathopods of the male, besides being more bulky than in the other sex, have the palm much more decidedly marked off from the hind margin and slightly sinuous. The second gnathopods of the male, instead of being smaller than the first, are much larger and have the oblong fifth joint notably longer than the sixth. The palm of the sixth is straight, oblique, nearly as long as the hind margin, overlapped by the moderately long finger. In the specimen dissected the branchial vesicles were strikingly small in comparison with the great size of the limb. The hand

and wrist in both gnathopods are furnished with many long setæ.

The first and second peraeopods resemble those of the female except in regard to the second joint, which is more expanded and has the front margin fringed with short spines as well as the setæ or slender spines with which the other sex appears to be content. The third peraeopods differ from those of the female also in regard to the second joint, this being in the male nearly as broad as long, instead of twice as long as broad. The fifth peraeopods of the male have a large group of very long setæ at the apex of the sixth joint, not perceived in the female.

In the peculiar third joint of the mandibular palp, the missing dorsal arch of the sixth pleon segment, the minute rami of the third uropods, and numerous other characters both sexes agree.

Localities.—Off Manning River; off Port Hacking; and off Wata Mooli, from 54-59 fathoms. The "Challenger" specimens were taken off Melbourne, at a depth of 33 fathoms. No doubt the supposed male had lost its second gnathopods.

Family PODOCERIDÆ.

Podoceridæ, Stebbing, Das Tierreich, xxi., 1906, p. 694.
Podoceridæ, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 521.

Genus PODOCERUS, *Leach.*

Podocerus, Leach, Edinb. Encycl., vii., 1814, p. 433.
Podocerus, Stebbing, Das Tierreich, xxi., 1906, pp. 700, 741.
Podocerus, Chevreux, Mém. Soc. Zool. Fr., xx., 1908, p. 521.

In 1908 Chevreux added a new species to this genus, from the Gambier Archipelago, naming it after the island at which it was taken, *P. mangarevæ.*

PODOCERUS HYSTRIX, *sp.nov.*

(Plate lviii.).

Stations 28, 35, 37, 57.

From the "Challenger" species, *Podocerus dancæ,* the present species may be distinguished by the more numerous processes on the peraeon, the different structure of the second gnathopods in the male, and the considerably smaller size. In its ornamentation it bears a striking resemblance to the species which Professor Haswell in 1888 described as *Cyrtophium* (?) *hystrix,* but subsequently transferred to *Lætmatophilus.* As Haswell had only a

single imperfect specimen, I was for a time persuaded that this imperfection had hindered him from recognising the true generic character which was obvious in the specimens of the present species procured by the "Thetis." This point of view, however, I have relinquished on reflecting that Haswell claimed for his specimen one of the distinguishing characters of *Lætmatophilus*, while he was evidently in ignorance that such a genus had been established. On transferring his species to it in 1885 he again insists on the characteristic pleon, and adds other features, saying:—"In this remarkable little species there are only five segments in the pleon and only five pairs of appendages. The antennæ are subequal and the superior pair have no appendage."

The general resemblance between Haswell's species and the present member of a nearly allied but distinct genus is further discounted by the circumstance that in the "Thetis" gathering there were included members of the Isopod family Astacillidæ, quite deceptively like these Amphipods. That organisms essentially different assume a similar garb under similar conditions of existence is not contrary to experience.

In *Podocerus hystrix* the head has a very short triangular rostrum and a large, forward-pointing, medio-dorsal process. In the centre line of the peraeon there are on the first segment two processes, the foremost the larger, pointing forward; of the three following segments each has an upward-pointing process, and with successive increase of size there is a backward-directed process to each of the next three segments. Similar processes surmount the first two segments of the pleon, these as well as those on the peraeon being flanked by corresponding rows of acute processes of moderate size. The borders of the peraeon segments are surmounted each by a tubercle and are acutely produced outwards over the side-plates, of which the first pair are sharply produced forwards, and the next three pairs more or less acutely downwards, while the remaining three have the lower border convex.

The eyes are dark, sub-globular, prominent at each side of the head, occupying the rounded ends of the eye-lobes, from the top of which a minute point may be seen projecting.

The first antennæ have the second joint much longer than the first, and readily break off between these two; the third joint is longer than the second or subequal to it; the flagellum is rather shorter than the second joint of the peduncle, with six joints, of which the first is much the longest. The accessory flagellum is one-jointed.

In the much longer second antennæ the fifth joint of the peduncle is longer than the fourth, this in turn being longer than the three-jointed flagellum.

The mouth-organs are in close agreement with those of the "Challenger" species, *Podocerus danæ*, and the same remark applies to the small first gnathopods, which are alike in both sexes.

The second gnathopods of the female are like those of *P. danæ*, but the second gnathopods of the male differ much from the pattern found in that species. They are distinguished from those of the female in slightly superior size, and in the circumstance that the palm, instead of pursuing a practically unbroken curve to the finger-hinge, before reaching that point forms a small tooth process followed by a slightly serrated setiferous flattened edge. In each sex the finger curves over the palm-defining projection of the short hind margin, within which one or two palmar spines are seated.

The peraeopods differ but little from those of *P. danæ*. The second joint even in the last three pairs is little dilated. All the joints except the short third and the strong fingers have several spines and setæ to which in preserved specimens extraneous matters cling, as they do also to the body processes. As in other species of the genus all the limbs have a desperate facility of detaching themselves from the bodies to which they properly belong.

The first and second uropods have the outer ramus shorter than the inner but longer than the peduncle. The first pair are much larger than the second. The third pair consist each of a membranaceous oval piece, shorter than the telson, and tipped with a single setule.

The telson is more or less conical, with a spinule on each side where it contracts towards its blunt end. This is armed with two pairs of spines, the median pair the longer. Ventrally there is a membranaceous plate, broader than long, with a set of three setules on each side near the broadly rounded apical margin. Length of an average specimen about 7 mm.

The specific name, from the Greek ὕστριξ, porcupine, alludes to the numerous processes of the body, and will serve to emphasize the resemblance which this species bears to *Lætmatophilus hystrix* in a neighbouring genus.

Localities.—Off Manning River; off Port Hacking; Botany Bay, 50-52 fathoms; off Wata Mooli, 54-59 fathoms.

Genus ICILIUS, *Dana*.

Icilius, Dana, Amer. Journ. Sci., (2), viii., 1849, p. 140.

Icilius, Stebbing, Das Tierreich, xxi., 1906, p. 706.

So recently as 1906 I was willing to accept the decision which Professor Della Valle published in 1893, that, although four

species had been named in this genus, it really contained only one, which in that case must be called *Icilius ovalis*, Dana. In the meantime, however, examination of various specimens collected by the "Thetis" Expedition has led me to a different conclusion. The grounds on which this change of opinion rests will now be explained. Unfortunately it cannot even now lay claim to finality, because the earlier descriptions suffer from obscurity or incompleteness, and among the newly acquired specimens of these fragile animals not a single one was perfect, not only every individual wanting some of its parts, but some of the parts being absent from the whole collection.

It should be borne in mind that Professor Haswell, who in 1880, figured and described two Australian species, first *I. australis* and then *I. punctatus*, in 1882 united them, remarking that "an examination of a series of specimens has made it appear probable that *I. australis* and *I. punctatus* are to be regarded as varieties of one species." He had previously stated that *I. punctatus* was "distinguished from *I. australis* chiefly by the greater breadth of the rami of the three posterior pairs of pleopoda" [uropods]. It remains doubtful whether in combining his two species he was influenced by any other character than this.

When instituting the species *I. dancæ* in 1888 for a female specimen taken at a depth of 33 fathoms off Melbourne, I pointed out the feature distinguishing it from Dana's typical *I. ovalis* taken in 31 fathoms north of Borneo. These gain a new importance from the steadfastness of character in the "Thetis" specimens which agree with the account of *I. dancæ*. I do not wish to deny that future discoveries may once more unite *I. ovalis* and *I. dancæ*, but I think it extremely improbable that such a union can be effected between *I. ovalis* and *I. australis*. In the existing state of knowledge the following synoptic table may be offered:—

1	First and second pleon segments with hind margin acutely produced at the middle—2.	
	First and second pleon segments with hind margin not acutely produced at the middle—3.	
2	Last segment of peraeon without, third segment of pleon with, acute process at middle of hind margin.....	1. *Icilius ovalis*, Dana.
	Last segment of peraeon with, third segment of pleon without, acute process at middle of hind margin.....	2. *Icilius dancæ*, Stebbing.
3	Postero-lateral margins of first and second pleon segments forming two strong teeth.....	3. *Icilius australis*, Haswell.
	Postero-lateral margins of first and second pleon segments forming no strong teeth.....	4. *Icilius punctatus*, Haswell

Dana's statements that the feet are all vergiform and that the first and second peraeopods, though a little stouter than the gnathopods, are still slender, are irreconcilable with the undoubtedly subchelate character of those peraeopods in Haswell's *I. punctatus*.

As will be presently explained, in "Das Tierreich" I have misdescribed the third uropod. The generic account should state that the outer ramus of this appendage is of variable length, sometimes longer than the peduncle.

ICILIUS DANÆ, *Stebbing*.

Icilius danæ, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1203, pl. cxxxiii.

(Plate lix.A.)

Stations 28, 57.

Almost all the specimens of this and the congeneric forms proved to be females as attested by their possession in common of very ample marsupial plates. In the present form eggs few and large were occasionally present. As already noticed, this species stands alone in having the hind margin of the seventh peraeon segment acutely produced at the middle. It differs from the other two Australian forms in a similar production of the first and second pleon segments, which are also laterally carinate, but agrees with *I. punctatus* in having the postero-lateral angles of those segments only minutely out-drawn. In all three forms the seventh is the longest of the peraeon segments, and the first is the longest of the pleon segments, with the exception of the fourth, which, however, when the tail is flattened out, is to a considerable extent concealed.

The mouth-organs and gnathopods apparently are in very close agreement in all the Australian forms. The peraeopods by their comparative slenderness contrast in this species with those of the other two forms, but so does the general build of the species itself, and some may argue that though sexually reproductive, these specimens are morphologically immature. The combination of characters does not make this very probable. In the fifth peraeopod the second joint evenly sinuous, convex above, concave below, ending in an acute tooth, descending below the adjoining tooth of the lower margin; the fourth joint is quite slender, compared with that joint in the other two forms.

The pleopods are very distinctive. In those of the first pair the peduncle is more than twice as long as broad, with parallel margins.

The uropods are slender, the peduncle in the first pair longer than the rami, of which the outer is shorter than the inner; the

peduncle of the second pair rather shorter than the inner ramus of the first, but much shorter than the inner ramus of the second at its greatest extension, the outer ramus of the second pair a little shorter than that of the first. As indicated, there is some amount of variability in these lengths, probably due to loss and recuperation, which would naturally most affect the longest ramus, the inner of the second pair. The third pair have in all three forms a short broad peduncle, strongly produced on the inner side. In this species the outer ramus extends beyond the produced part of the peduncle, and may even considerably exceed the whole peduncle in length. This is so different from what is seen in the other two Australian forms that I distrusted my figure and description in the "Challenger" Report, supposing that the rather elongate ramus there given must be the inner. Accordingly in "Das Tierreich" I stated that the outer ramus was "not shown in fig. 125, p.707," whereas it is certainly the inner ramus that is missing, not only from the figure, but from all the specimens which have come under my hands. Dana says that in *I. ovalis* these rami are "quite unequal." His figure shows two rather long slender branches, of which the inner is considerably the shorter. Dana describes the telson as "small ovate," and so it is here, with some minute spinules in notches leading to an acute tip. Length, from front of head to telson, not including uropods, 7 or 8 mm.

Locality.—Off Manning River, and off Wata Mooli, from 54 to 59 fathoms.

ICILIUS PUNCTATUS, *Haswell.*

(Plate lix.B.)

Station 44.

Icilius punctatus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 343, pl. xxiii., fig. 1f, h, i, x.

In this form there are no medio-dorsal projections of the body segments and the postero-lateral angles of the first two pleon segments are only minutely produced. The fifth peraeopod has the second joint not longer than broad as in the preceding species, but with a proximal breadth equal to the length, the hind margin making a broadly rounded bulge at the upper part and then descending rather obliquely but straight to the apical tooth, which is scarcely so much produced as the adjacent tooth of the lower margin. The fourth joint is broad and well furnished with plumose setæ and spines.

The pleopods have broad peduncles, reaching on the inner side considerably beyond the bases of the rami. Their lateral mar

gins converge slightly upwards, and the inner margin at the top projects inward a small well-marked blunt process.

The uropods agree so closely with Professor Haswell's figure of these appendages in his *I. punctatus* that the identification is tolerably secure. The rami of the first two pairs very nearly agree, though the outer ramus of the first is rather longer than that of the second pair. All are strongly fringed with spines and have besides a microscopic spinular fringe. The third uropods have a short peduncle, produced on the inner side, probably as a support to the large foliaceous inner ramus, which is as long as that of the first pair and broader, fringed with spines and carrying some on its surface rather near the base. In contrast to this the little oval outer ramus, with a single small spine on the outer margin near the apex, does not even reach the end of the peduncular process. The telson appears to be more rounded than in the other forms. It has a pair of spinules on the convex distal margin. This species, without being longer than the preceding, is broader and more robust.

Locality.—Off Coogee.

ICILIUS AUSTRALIS, *Haswell.*

(Plate lix. c.)

Station 57.

Icilius australis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 274, pl. xii., fig. 2, a, b, c.

This form is the bulkiest of the three, and so far conforms to the ideal suggested by Professor Haswell's original figure of *I. australis*. The head is of great width with the eyes very prominent. The back is devoid of median processes, but the first two pleon segments are postero-laterally double-toothed. Also they have numerous spinules on or near the hind margins of these segments, which were not to be detected in the other forms. In the fifth peraeopods the large second joint's hind margin forms quite a narrow bulge at the top, and then descends with sinuous sweep to the two subequal teeth below. The fourth joint is very broad and strongly spinose.

The pleopods have the peduncles more dilated below than those of *I. punctatus*, and in the third pair the outer margin shows a fringe of spines much stronger than those present in the species ust named.

The first and second uropods were not in good condition, the inner ramus was wanting to the third, but here the outer ramus, though shorter than the peduncle, extended beyond it and

exhibited five spines along the outer margin and apex. The telson has a pair of small spines at the obtusely triangular apex. Length, not more than twice the breadth.

Locality.— Off Wata Mouli, from 54 to 59 fathoms.

Genus DODECAS, *Stebbing.*

Dodecas, Stebbing, Ann. Mag. Nat. Hist., (5), xi., 1883, p. 207.

Dodecas, Stebbing, Chall. Rep., Zool., xxix., 1888, pp. 547, 1232.

Dodecas, P. Mayer, Flora Fauna Neapel, xvii., 1890, pp. 4, 6, 8, 15, 105, &c.

Dodecas, P. Mayer, Siboga Expeditie, xxxiv., 1903, p. 29.

Dr. Mayer, when adding a second species to the genus in 1903, remarks that the diagnosis of the genus remains unaltered, and gives its characters as mandibular palp three-jointed, flagellum of second antennæ at most five-jointed, first peraeopod with normal number of joints, second wanting, third with four free joints, branchial vesicles on peraeon segments 2-4, pleon in the male with three, in the female with two pairs of appendages.

A slight change is now required, since the species about to be described attains a greater number than five in the joints of the second antennæ. It may be distinguished from its companions as follows :—

1	Body smooth	1. *Dodecas elongata*, Stebbing.
	Body with spine-like processes—2.	
2	Body of male six-spined; flagellum of first antennæ seven-jointed	2. *Dodecas hexacentrum*, Mayer.
	Body of male ten-spined ; flagellum of first antennæ more than seven-jointed	3. *Dodecas decacentrum*, sp nov.

Another mark by which the new species is distinguished from *D. hexacentrum* is found in the branchial vesicles, which do not decrease in size successively backwards, the middle one being notably the largest.

DODECAS DECACENTRUM, *sp.nov.*

(Plate lx.).

Stations 35, 37, 57.

This species so much resembles *Dodecas hexacentrum*, the Australian species described by Dr. Paul Mayer, that at the first glance I took it for granted that its name was already established. On closer examination this view proved untenable. Fortunately the specimens which Dr. Mayer received from Watson Bay, Port

Jackson, were very numerous. So also were those procured by the "Thetis" Expedition at the neighbouring stations of Port Hacking and Botany Bay. At all three localities there were many females, with brood pouches, but no larvæ in them. That the two forms cannot be united will, I think, be made clear by the following comparison of their characters.

In the earlier species the body has a pair of dorsal spines at the end of the first peraeon segment, a similar pair on the middle of the second segment, which also carries a spine over the base of each of the second gnathopods, thus furnishing to the adult male the six spine-processes to which the specific name refers. The first pair is wanting or feebly developed in the female and young male. The new species has a dorsal pair at the end of the first segment, one in the middle, and one at the end of the second, and two other pairs, arming respectively the third and fourth segments at the middle. It is to these ten processes in a continuous line of pairs that the name *decacentrum* alludes, without taking into account the lateral processes which are difficult to see even over the second gnathopods, and still more in position far below the first and fifth dorsal pairs. Here also the female has a smaller apparatus, the first and fourth segments having lost their armature. On the second segment moreover the first pair is moved forward in correspondence with the altered position of the second gnathopods in the female sex.

Mayer describes the first antennæ in his species as very long, especially in the male, and with curved basal joints; the flagellum in both sexes seven-jointed, the first joint in the male being relatively very long; flagellum of the second antennæ in the male five-jointed, in the female four-jointed. The new species agrees in so far that the first antennæ are very long, and in the male the last joint of the peduncle is commonly longer than the penultimate, whereas in the female those two joints are subequal, but in both sexes the number of joints in the flagellum, though very variable, may ascend far beyond seven. In one female specimen it contained nineteen joints, in a male specimen seventeen, the joints slender and elongate, the first always the longest. Sometimes the basal joints of the peduncle show a slight curvature, but often they are quite straight. The slender flagellum of the second antennæ is usually seven-jointed, but may be eight-jointed.

For the fringing spines of the third joint in the mandibular palp Dr. Mayer gives the numbers 1 + 11 + 1, In two examined specimens of the new species the number is 1 + 14 + 1 and 1 + 15 + 1. Such minutiæ, however, are very likely to be subject to much variation. Dr. Mayer notes that the third joint of the maxilliped palp has distally a process. Such a process is present also in our species, but it is very small.

In Dr. Mayer's species the three pairs of branchial vesicles from front to rear decrease considerably in size. This is not the case with the new species. Though the first pair is larger than the third, the second is very conspicuously larger than the first, in both sexes.

The fourth and fifth peraeopods are only rarely found in position. For the sixth joint in the Port Jackson specimens Dr. Mayer describes the clasping spines as consisting of one pair and two that are impaired. In the new species near the proximal end there are in both sexes two successive pairs of spines and a single spine near the hinge of the finger.

This assemblage of differences should suffice to discriminate the two species. That they should be found in unmixed numbers in apparently close proximity, is of no controversial importance apart from more precise information as to the exact conditions of capture in each case, or, in modern phrase, as to the œcology of the two species.

The new species has the eyes rounded, very prominent, dark red in spirit. The mouth-organs are in near agreement with those of *Dodecas elongata*. In the second gnathopods the fifth joint is as usual short in the female, but long and slender in the male, distinct from the sixth but without separate mobility. The palm of the sixth joint has two emarginations, of which the distal one is the longer, but veiled by a transparent membrane.

The pleon is in near agreement with that of *Dodecas elongata*, having in the male at the base a ventral median plate carrying a minute pair of oval pleopods, each ending in a seta.[13] The platt alone is present in the female. The uropods are in agreement with those of *D. elongata*, except that the first pair does not so greatly exceed the length of the second.

Three male specimens measured, respectively, 18·5, 18, 17·5mm. Of the first, the first antenna, with flagellum broken after the 8th joint measured 14 mm., of the second the antenna was only 10·5 mm. long, of the third the antenna with flagellum complete was 14 mm. A female specimen, 17 mm. long, had a first antenna 9·5 mm. in length, of which the 19-jointed flagellum measured 4·5 mm.

Localities.—Port Hacking; Botany Bay, from depth of 50-52 fathoms off Wata Mooli, from 54-59 fathoms.

Genus ORTHOPROTELLA, *Mayer.*

Orthoprotella, Mayer, Siboga Expeditie, xxxiv., 1903, p. 35.

Distinguished from *Protella* (in its latest restriction) chiefly by the pleon of the male, which carries one pair of two-jointed rudi-

[13] See Mayer—*Loc. cit.*, 1890, p. 126, pl. v., fig. 7.

mentary pleopods. The coalescence of the sixth and seventh segments of the peraeon is as advanced as in *Protella*.

ORTHOPROTELLA AUSTRALIS (*Haswell*).

Station 28.

Protella australis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1880, p. 276, pl. xii., fig. 4, a, b.

Protella australis, Haswell, Proc. Linn. Soc. N. S. Wales, ix., 1885, p. 997, pl. xlix., figs. 2-4.

Orthoprotella australis, Mayer, Siboga-Expeditie, xxxiv., 1903, p. 35, pl. i., figs. 23-26, pl. vi., figs. 43-49, pl. ix., figs. 14, 37, 57, 58.

Under the last reference will be found a clue to earlier discussions concerning this species and all the available information about it. In the "Thetis" specimen, a male, the flagella of the upper antennæ are broken, and the last three pairs of peraeopods are missing. A second specimen, only 3·5 mm. long, dorsally smooth, has six joints on the somewhat imperfect flagellum of an upper antenna, three and two respectively on the flagella of the lower pair; one hind peraeopod (fourth or fifth, being now detached) has two spines on proximal prominence of sixth joint, with a succession of six spinules along concave margin.

Locality.—Off Manning River.

APPENDIX.

CATALOGUE OF AUSTRALIAN AND TASMANIAN AMPHIPODA.

GAMMARIDEA.

Family LYSIANASSIDÆ.

AMARYLLIS MACROPHTHALMA, *Haswell.*

See ante, p. 569.

AMARYLLIS BATHYCEPHALA, *Stebbing.*

Amaryllis bathycephalus, Stebbing, Chall. Rep., Zool., xxix., 1888, p 699, pl. xxvii.; *Amaryllis bathycephala*, Stebbing, Das Tierreich, xxi., 1906, p. 24.

ONESIMOIDES CARINATUS, *Stebbing.*

Onesimoides carinatus, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 648, pl. xiv.; *Id.*, Das Tierreich, xxi., p. 32.

SOCARNOIDES STEBBINGI, *G. M. Thomson.*

Lysianax stebbingi, G. M. Thomson, Proc. Roy. Soc. Tas., 1893, 1892, p. 19. pl. iii., fig. 9-18 ; pl. v , fig. 9, 10. *Socarnoides stebbingi*, Stebbing, Das Tierreich, xxi., 1906, p. 47.

WALDECKIA CHEVREUXI, *sp.nov.*

See ante, p. 572.

SOCARNES KROYERI, *White.*

Ephippiphora kroyeri, White, Proc. Zool. Soc., Lond., xv., 1847, p. 124. See ante, discussion under *Waldeckia*, p. 570.

HIPPOMEDON GEELONGI, *Stebbing.*

Hippomedon geelongi, Stebbing, Chall. Rep., Zool., xxix., 1888 p. 635, pl. xi.; *Id.*, Das Tierreich, xxi., 1906, p. 60.

GLYCERINA TENUICORNIS, *Haswell.*

Glycera tenuicornis. Haswell, Proc. Linn. Soc., N. S. Wales, iv., 1879, p. 256. pl. viii., fig 6; *Glycerina tenuicornis*, Haswell, Austr. Mus. Cat., v., 1882, Crust., p. 234, pl. iv., fig. 3. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 61.

TRYPHOSA CAMELUS, *sp.nov.*

See ante, p. 574.

TMETONYX MIERSI, *Stebbing.*

Hippomedon miersi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 631, pl. x.; *Tmetonyx*, *Id.*, Das Tierreich, xxi., 1906, p. 75.

LYSIANASSA NITENS, *Haswell.*

Lysianassa nitens, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 255, pl. viii., fig. 5. *Anonyx nitens*, Haswell, Proc. Linn. Soc. N. S. Wales, x., 1885, p. 98, pl. xii., figs. 1, 2. Genus still uncertain.

LYSIANASSA AFFINIS, *Haswell.*

Lysianassa affinis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 256; *Ibid.*, x., 1885, p. 99, pl. xii., figs. 5, 6.

LYSIANASSA AUSTRALIENSIS, *Haswell.*

Lysianassa australiensis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 323, pl. xviii., fig. 3, f, g; *Ibid.*, x., 1885, p. 99, pl. xii., figs. 3, 4. This, like the two preceding species, is generically doubtful.

Family STEGOCEPHALIDÆ.

ANDANIOTES CORPULENTUS, *G. M. Thomson.*

See ante, p. 575.

STEGOCEPHALUS LATUS, *Haswell.*

Stegocephalus latus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 252, pl. viii., fig. 2, a, b; *Ibid.*, x., 1885, p. 97, pl. xi., figs. 7-12. Genus doubtful (? *Steyocephaloides*, Sars.)

Family AMPELISCIDÆ.

AMPELISCA AUSTRALIS, *Haswell.*

Ampelisca australis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 257, pl. ix., fig. 1, a, b, c, d. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 104.

AMPELISCA PUSILLA, *Sars.*

See ante, p. 576.

AMPELISCA ACINACES, *Stebbing.*

Ampelisca acinaces, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1036, pls. ci., cii. *Id.*, G. M. Thomson, Ann. Mag. Nat. Hist., (7), x., 1902, p. 464. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 108, figs. 25, 26.

Family HAUSTORIIDÆ.

PLATYISCHNOPUS MIRABILIS, *Stebbing.*

Platyischnopus mirabilis, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 830, pl. lviii; *Id.*, Das Tierreich, xxi., 1906, p. 123.

A. O. Walker (Rep. Ceylon Pearl Fish., ii., 1904, p. 246) forms a new family Argissidæ for *Platyischnopus*, Stebbing, and *Argissa*, Boeck.

Family PHOXOCEPHALIDÆ.

PHOXOCEPHALUS BASSI, *Stebbing.*

Phoxocephalus bassi, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 811, pl. liv.; *Id.*, Das Tierreich, xxi., 1906, p. 135.

PONTHARPINIA PINGUIS, *Haswell.*

Urothoë pinguis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 325, pl. xix., fig. 2, a, b, c. e, f, p, x. *Pontharpinia pinguis*, Stebbing, Das Tierreich, xxi., 1906, p. 146.

PONTHARPINIA ROSTRATA, *Dana.*

Urothoë rostratus, Dana, Wilkes U.S. Expl. Exp., xiii., 1853, p. 921. *Phoxus batei*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 259, pl. ix., fig. 3, a, b. *Phoxocephalus batei* and *Phoxocephalus rostratus*, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 1717; *Pontharpinia rostrata*, Stebbing, Das Tierreich, xxi., 1906, p. 146.

PARHARPINIA VILLOSA, *Haswell.*

Phoxus villosus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 258, pl. ix., fig. 2, a, b. *Parharpinia villosa*, Stebbing, Das Tierreich, xxi., 1906, p. 147.

Family AMPHILOCHIDÆ.

AMPHILOCHUS MARIONIS, *Stebbing.*

See ante, p. 577.

CYPROIDEA ORNATA, *Haswell.*

See ante, p. 578.

PARACYPROIDEA LINEATA, *Haswell.*

Cyproidia lineata, Haswell, Proc. Linn. Soc. N.S.Wales, iv., 1879, p. 321, pl. xviii., fig. 2, f, g. *Paracyproidea lineata*, Stebbing, Das Tierreich, xxi., 1906, p. 160.

GITANOGEITON SARSI. *gen. et sp.nov.*

See ante, p. 579.

Family LEUCOTHOIDÆ.

LEUCOTHOE COMMENSALIS, *Haswell.*

See ante, p. 580.

LEUCOTHOE BREVIDIGITATA, *Miers.*

Leucothoe brevidigitata, Miers, Rep. Voy. Alert, 1884, p. 313, pl. xxxiv., fig. A. *Leucothoe flindersi*, Stebbing, Chall. Rep. Zool., xxix., 1888, p. 779, pl. xlviii.; *Leucothoe brevidigitata*, Stebbing, Das Tierreich, xxi., 1906, p. 167.

LEUCOTHOE DIEMENENSIS, *Haswell.*

Leucothoe diemenensis, Haswell, Proc. Linn. Soc. N. S.Wales, iv., 1879, p. 262, pl. ix , fig. 5.

LEUCOTHOE GRACILIS, *Haswell.*

Leucothoe gracilis, Haswell, Proc. Linn. Soc. N. S.Wales, iv., 1879, p. 263, pl. x. fig. 2.

It is unlikely that these names represent four distinct species. Dr. Della Valle (1893) may be right in practically uniting them all with *Leucothoe spinicarpa*, Abildgaard, which A. O. Walker (1909) declares to be cosmopolitan.

PARALEUCOTHOE NOVÆHOLLANDIÆ, *Haswell.*

See ante, p. 581.

Family STENOTHOIDÆ.

STENOTHOE MIERSII, *Haswell.*

Montagua miersii, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 323, pl. xxiv., fig. 4, f. *Montagua longicornis*, Haswell, *ibid.*, p. 323, pl. xxiv., fig. 5, f, g, x. *Montaguana miersii*, Chilton, Trans. N. Zealand Inst., xv., 1883, p. 79 ; *Probolium miersii*, Chilton, Proc. Linn. Soc. N. S. Wales, ix., 1885, p. 1043. *Stenothoe miersii*, Stebbing, Das Tierreich, xxi., 1906, p. 200. The species is still obscure.

Family PHLIANTIDÆ.

PALINNOTUS THOMSONI, *Stebbing.*

Pereionotus thomsoni, Stebbing, Trans. Linn. Soc., vii., 1899, p. 417, pl. xxxvA. *Palinnotus thomsoni*, Stebbing, Das Tierreich, xxi., 1906, p. 202.

IPHIPLATEIA WHITELEGGEI, *Stebbing.*

Iphiplateia whiteleggei, Stebbing, Trans. Linn. Soc., vii., 1899, p. 415, pl. xxxiv.; *Id.*, Das Tierreich, xxi., 1906, p. 203, fig. 52, 53.

Family COLOMASTIGIDÆ

COLOMASTIX BRAZIERI, *Haswell.*

Colomastix brazieri, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 341, pl. xxii., fig. 4, e, f, g, x. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 206.

Family OCHLESIDÆ.

OCHLESIS INNOCENS, *gen. et sp.nov.*

See ante, p. 582.

Family ACANTHONOTOZOMATIDÆ.

IPHIMEDIA AMBIGUA, *Haswell.*

See ante, p. 584, for discussion of this species, though not included in the "Thetis" collection.

IPHIMEDIA DISCRETA, *sp.nov.*

See ante, p. 586.

IPHIMEDIA STIMPSONI, *Bate.*

Iphimedia obesa, Stimpson (*non* Rathke), Proc. Acad. Nat. Sci. Philad., vii., 1855, p. 393. *I. stimpsoni*, Bate, Cat. Amph. Brit. Mus., 1862, p. 374. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 217.

Family LILJEBORGIIDÆ.

LILJEBORGIA DUBIA, *Haswell.*

Eusirus dubius, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 331, pl. xx., fig. 3, e, f, x; *Id.*, var. *ibid.*, x., 1885, p. 100, pl. xiv., fig. 1; *Eusirus affinis*, *ibid.*, p. 101, pl. xiv., fig. 2-4. *Liljeborgia haswelli*, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 895, pl. xcii. *Id.*, G. M. Thomson, Ann. Mag. Nat. Hist., (7), x., 1902, p. 463. *Liljeborgia dubia*, Stebbing, Das Tierreich, xxi., 1896, p. 233. *Lilljeborgia dubia*, A. O. Walker, Nat. Antarct. Exp., iii., 1907, p. 35.

LILJEBORGIA ÆQUABILIS, *Stebbing.*

See ante, p. 588.

Family ŒDICEROTIDÆ.

EXŒDICEROS FOSSOR, *Stimpson.*

Œdicerus fossor, Stimpson, Proc. Ac. Nat. Sci. Philad., vii., 1855, p. 393. *Œdicerus arenicola*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 325, pl. xxiv., fig. 3, f, g, h, k, m. *Exœdiceros fossor*, Stebbing, Das Tierreich, xxi, 1906, p. 239.

ŒDICEROS LATRANS, *Haswell.*

Œdicerus latrans, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 324, pl. xix., fig. 1, e, f, g, h, k, l, m, p, x. *Œdiceros latrans*, Stebbing, Das Tierreich, xxi., 1906, p. 245. The species is still obscure.

ŒDICEROIDES ORNATUS, *Stebbing.*

See ante, p. 589.

Family TIRONIDÆ.

BRUZELIA AUSTRALIS, *sp.nov.*

See ante, p. 590.

SYRRHOE SEMISERRATA, *Stebbing.*

Syrrhoe semiserrata, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 793, pl. li.; *Id.*, Das Tierreich, xxi., 1906, p. 283.

Family CALLIOPIIDÆ.

SANCHO PLATYNOTUS, *Stebbing.*

Sancho platynotus, Stebbing, Trans. Linn. Soc., vii., 1897, p. 42, pl. ix.A.; *Id.*, Das Tierreich, 1906, p. 288, fig. 72, 73.

PARACALLIOPE FLUVIATILIS, *G. M. Thomson.*

Calliope fluviatilis, G. M. Thomson, Trans. N. Zealand Inst., xi., 1879, p. 240, pl. x.C., fig. 4, a-c. *Pherusa australis*, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 103, pl. vii., fig. 1, f, g, x. *Paracalliope fluviatilis*, Stebbing, Das Tierreich, xxi., 1906, p. 297.

HARPINIOIDES DREPANOCHEIR, *Stebbing.*

See ante, p. 592.

APHERUSA LÆVIS, *Haswell.*

Pherusa laevis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 260, pl. ix., fig. 4, a, b. The species still obscure.

Family ATYLIDÆ.

NOTOTROPIS HOMOCHIR, *Haswell.*

Atylus homochir, Haswell, Proc. Linn. Soc. N. S. Wales, x., 1885, p. 101, pl xiii., fig. 5-7. *Nototropis homochir*, Stebbing, Das Tierreich, xxi., 1906, p. 333, fig. 77, 78.

Family EUSIRIDÆ.

EUSIROIDES MONOCULOIDES, *Haswell.*

See ante, p. 595.

EUSIROIDES CRASSI, *Stebbing.*

See ante, p. 594.

EUSIROIDES LIPPUS, *Haswell.*

Atylus lippus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879 p. 328, pl. xx., fig. 1 a, b, c, e, f, g, x. *Eusiroides lippus*, Stebbing, Das Tierreich, xxi., 1906, p. 346. Species still obscure.

Family PONTOGENEIIDÆ.

PONTOGENEIA TASMANIÆ, *G. M. Thomson.*

Atyloides tasmaniæ, G. M. Thomson, Proc. Roy. Soc. Tas., 1892 (1893), p. 21, pl. ii., fig. 9-15, pl. iii., fig. 1, 2. *Pontogeneia tasmaniæ*, Stebbing, Das Tierreich, xxi., 1906, p. 361. Species still obscure.

ATYLOIDES SERRATICAUDA, *Stebbing.*

Atyloides serraticauda, Stebbing, Chall. Rep., Zool., xxix., 1888, p. 920, pl. lxxviii. *Id.*, A. O Walker, Journ. Linn. Soc., xxix., 1903, p. 58, pl. xi., fig. 90. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 362. *Id.*, Chevreux, Exp. Antarct. Franç. Amphip., 1906, p. 87.

ATYLOIDES GABRIELI, *Sayce.*

Atyloides gabrieli, Sayce, Proc. Roy. Soc. Vict., xiii., 1901, p. 230, pls. xxxvii., xxxviii.

ATYLOIDES FONTANUS, *Sayce.*

Atyloides fontanus, Sayce, Proc. Roy. Soc. Vict., xv., 1902, p. 49, pl. v.

PARAMŒRA AUSTRINA, *Bate.*

Atylus austrinus, Bate, Cat. Amph. Brit. Mus., 1862, p. 137, pl. xxvi., fig. 4. *Paramœra australis*, Miers, Ann. Mag. Nat. Hist., (4), xvi., 1875, p. 75. *Atylus megalophthalmus*, Haswell, Proc. Linn. Soc. N.S. Wales, v., 1880, p. 102, pl. vi., fig. 4, a, f, f^1, g, g^1, p. *Paramœra austrina*, Stebbing, Das Tierreich, xxi., 1906, p. 363. Not certainly distinct from the next species.

PARAMŒRA SIMPLEX, *Dana.*

Amphitoe (Iphimedia) simplex, Dana, Proc. Amer. Acad., ii., 1852, p. 217. *Atylus microdeuteropus*, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 102, pl. vi., fig. 3, a, b, f, g, p, x.

PARAMŒRA FASCICULATA, *G. M. Thomson.*

Megamœra fasciculata, G. M. Thomson, Ann. Mag. Nat. Hist., (5), vi., 1880, p. 5, pl. i., fig. 5; *Mœra fasciculata*, G. M. Thomson, Proc. Roy. Soc. Tas., 1893, 1892, p. 28. *Mœra fasciculata*, Chilton, Trans. N. Zealand. Inst., xxxviii., 1906, p. 271.

Family GAMMARIDÆ.

PARAPHERUSA CRASSIPES, *Haswell.*

Harmonia crassipes, Haswell, P. Linn. Soc. N.S. Wales, iv., 1880, pp. 330, 349, pl. xix., fig. 3; *Id.*, x., 1885, p. 106, pl. xvi., fig. 9. *Parapherusa crassipes*, Stebbing, Das Tierreich, xxi., 1906, p. 383.

AMATHIBLOPSIS AUSTRALIS, *Stebbing.*

Amathiblopsis australis, Stebbing, Ann. Mag. Nat. Hist., (5), xi., 1883, p. 205. *Id.*, Das Tierreich, xxi., 1906, p. 385.

NEONIPHARGUS THOMSONI, *Stebbing.*

Neoniphargus montanus, G. M. Thompson, Proc. Roy. Soc. Tas., 1892 (1893), p. 70, pl. vi., fig. 1-13. *Neoniphargus thomsoni*, Stebbing, Trans. Linn. Soc., vii., 1899, p. 425. *Neoniphargus montanus*, Sayce, Ann. Mag. Nat. Hist., (7), viii., 1901, p. 562; *Unimelita montanus*, Sayce, Proc. Roy. Soc. Vict., xiii., 1901, p. 237. *Neoniphargus thomsoni*, Sayce, *Id.*, xv. 1902, p. 58. *Id.*, Stebbing, Das Tierreich, xxi., 1906, pp. 404, 731.

NEONIPHARGUS SPENCERI, *Sayce.*

Unimelita spenceri, Sayce, Proc. Roy. Soc. Vict., xiii., 1901, p. 238, pl. xl.; *Neoniphargus spenceri*, Sayce, *id.*, xv., 1902, p. 57. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 731.

NEONIPHARGUS, FULTONI, *Sayce.*

Neoniphargus fultoni, Sayce, Proc. Roy. Soc. Vict., xv., 1902, p. 57, pl. vii. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 731.

NIPHARGUS MORTONI, *G. M. Thomson.*

Niphargus mortoni, G. M. Thompson, Proc. Roy. Soc., Tas., 1892 (1893), p. 58, pl. iv., figs. 11, 12., pl. v., fig. 1-5. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 731.

NIPHARGUS PULCHELLUS, *Sayce.*

Niphargus pulchellus, Sayce, Proc. Roy. Soc. Vict., xii., 1900, p. 152, pls. xv., xvi.; *Id.*, Ann. Mag. Nat. Hist., (7), viii., 1901, p. 558. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 731.

PARELASMOPUS SULUENSIS, *Dana.*

Gammarus suluensis, Dana, Proc. Am. Ac., ii., 1852, p. 210. *Parelasmopus suluensis*, Stebbing, Rep. Voy. Challenger, xxix., 1888, pl. c.; Stebbing, Das Tierreich, xxi., 1906, pp. 417, 732. *Id.*, Chevreux, Mém. Soc. Zool. France, xx., 1908, p. 478.

MELITA FRESNELII, *Audouin.*

See ante, p. 596.

PARACERADOCUS MICRAMPHOPUS, *sp.nov.*

See ante, p. 597.

CERADOCUS RUBROMACULATUS, *Stimpson.*

See ante, p. 598.

MÆRA INAEQUIPES, *A. Costa.*

See ante, p. 599.

MÆRA HAMIGERA, *Haswell.*

See ante, p. 600.

MÆRA MASTERSII, *Haswell.*

Megamoera Mastersii, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 265, pl. xi., fig. 1, a, b, x. *Megamoera thomsoni*, Miers, Rep. Voy. Alert, 1884, p. 318, pl. xxxiv., fig B. *Maera mastersii*, Stebbing, Das Tierreich, xxi, 1906, p. 439. *Maera mastersi*, Chevreux, Mém. Soc. Zool France, xx., 1908, p. 481.

MÆRA RAMSAYI, *Haswell.*

Melita? Ramsayi, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 264, pl. x, fig. 1, a, b; *Moera Ramsayi*, Haswell, *ibid.*, p. 334.

MÆRA SPINOSA, *Haswell.*

Moera spinosa, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 268, pl. x., fig. 5, a, b, c.

MÆRA FESTIVA, *Chilton.*

Moera festiva, Chilton, Proc. Linn. Soc. N. S. Wales, ix., 1885, p. 1037, pl. xlvi., fig. 2, a, b, c. *Moera festiva*, Stebbing, Das Tierreich, xxi., 1906, pp. 431, 732.

In *Das Tierreich* this and the two preceding species are made synonyms of *Ceradocus rubromaculatus*, but the position of all three should rather be regarded as still doubtful. *M. festiva* shows agreement with Haswell's *M. hamigera*.

ELASMOPUS SUBCARINATUS, *Haswell.*

See ante, p. 602.

ELASMOPUS DIEMENENSIS, *Haswell.*

Megamœra diemenensis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 266, pl. xi., fig. 3. *Elasmopus diemenensis*, Stebbing, Das Tierreich, xxi., 1906, p. 442.

ELASMOPUS SUENSIS, *Haswell.*

Megamœra suensis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 335, pl. xxi., fig. 5f, 5g. *Elasmopus suensis*, Stebbing, Das Tierreich, xxi., 1906, p. 442.

ELASMOPUS VIRIDIS, *Haswell.*

Moera viridis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 333, pl. xxi., fig 2, f, g, p, x. *Elasmopus viridis*, Stebbing, Das Tierreich, xxi., 1906, p. 445. *Id.*, Chevreux, Mém. Soc. Zool. France, xx., 1908, p. 482.

ELASMOPUS BOECKII, *Haswell.*

Megamœra boeckii, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 336, pl. xxi, fig. 6f, 6g. *Elasmopus boeckii*, Stebbing, Das Tierreich, xxi., 1906, p. 445.

ELASMOPUS CRASSIMANUS, *Miers.*

Moera crassimana, Miers, Rep. Voy. Alert, 1884, p. 316. *Elasmopus crassimanus*, Stebbing, Das Tierreich, xxi., 1906, p. 445. The species is still obscure.

GAMMARUS AUSTRALIS, *Sayce.*

Gammarus australis, Sayce, Proc. Roy. Soc. Vict., xiii., 1901, p. 233, pl. xxxix.; *Ibid.*, xv., 1902, p. 51.

GAMMARUS HAASEI, *Sayce.*

Gammarus haasei, Sayce, Proc. Roy. Soc. Vict., xv., 1902, p. 53, pl. vi. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 733.

Family DEXAMINIDÆ.

DEXAMINE MIERSII, *Haswell.*

Dexamine miersii, Haswell, Proc. Linn. Soc. N. S. Wales, x., 1885, p. 102, pl. xiii, figs. 8-12. The species is still obscure.

PARADEXAMINE PACIFICA, *G. M. Thomson.*

Dexamine pacifica, G. M. Thomson, Trans. N. Zealand Inst., xi., 1879, p. 238, pl. x.B, fig. 4. *Paradexamine pacifica*, Stebbing, Das Tierreich, xxi., 1906, p. 518.

PARADEXAMINE FLINDERSI, *Stebbing.*

See ante, p. 603.

POLYCHERIA ANTARCTICA, *Stebbing.*

Dexamine antarctica, Stebbing, Ann. Mag. Nat. Hist., (4), xv., 1875, p. 184, pl. xv. A, fig. 1; *Polycheria antarctica*, Stebbing, Das Tierrich, xxi., 1906, p. 520. *Id.*, A. O. Walker, Nat. Antarct. Exp., iii., 1907, p. 34.

POLYCHERIA TENUIPES, *Haswell.*

Polycheria tenuipes, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 345, pl. xxii., fig. 8, e, f, g. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 520.

POLYCHERIA BREVICORNIS, *Haswell.*

Polycheria brevicornis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 346. *P. tenuipes*, Stebbing, Das Tierreich, xxi., 1906, p. 520. This and the preceding species are still obscure.

Family TALITRIDÆ.

TALITRUS SYLVATICUS, *Haswell.*

Talitrus sylvaticus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 246, pl. vii, fig. 1, a, b, b^1, c, d; *Talitrus assimilis*, Haswell, *ibid.*, v., 1880, p. 97, pl. v., fig. 1g; *Talitrus sylvaticus* and *Talitrus affinis* (error for *assimilis*), *ibid.*, x., 1885, p. 95, pl. x., fig. 1. *T. sylvaticus*, Stebbing, Das Tierreich, xxi., 1906, p. 524.

ORCHESTIA MARMORATA, *Haswell.*

Talorchestia? marmorata, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 99, pl. v., fig. 3, f. *Orchestia marmorata*, Stebbing, Das Tierreich, xxi., 1906, p. 536.

ORCHESTIA PICKERINGII, *Dana.*

Orchestia pickeringii, Dana, Wilkes U. S. Expl. Exp., xiii., 1853, pp. 882, 1595, pl. lix, fig. 9. *Orchestia macleayana*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 250, pl. vii., fig. 2, a, b, d. ?*Allorchestes crassicornis*, var. *coogeensis*, Chilton, *ibid.*, ix., 1885, p. 1035, pl. xlvi., fig. 1a, 1b. *Orchestia pickeringii*, Stebbing, Das Tierreich, xxi, 1906, p. 538.

TALORCHESTIA PRAVIDACTYLA, *Haswell.*

Talorchestia pravidactyla, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 100, pl. v., fig. 5, f, f, g. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 546.

TALORCHESTIA LIMICOLA, *Haswell.*

Talorchestia limicola, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 98, pl. v., fig. 2, f, f, g, g. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 547.

TALORCHESTIA QUADRIMANA, *Dana.*

Orchestia quadrimana, Dana, Proc. Amer. Acad., ii., 1852, p. 204. *Id.*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 248, pl. vii., fig. 3, a, b, c, d, e. *Id.*, Stebbing, Das Tierreich, xxi, 1906, p. 548.

TALORCHESTIA DIEMENENSIS, *Haswell.*

Talorchestia diemenensis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 248, pl. vii., fig. 6a, b, c, d. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 548.

TALORCHESTIA SPINIPALMA, *Dana.*

Orchestia spinipalma, Dana, Proc. Amer. Acad., ii., 1852, p. 203 *Talorchestia terræ-reginæ*, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 98, pl. v., fig. 4, f, f, g, and 2g on right of plate (by error for 4g). *Talorchestia spinipalma*, Stebbing, Das Tierreich, xxi., 1906, p. 552.

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TALORCHESTIA NOVÆ-HOLLANDIÆ, *Stebbing.*

Talorchestia novæ-hollandiæ, Stebbing, Trans. Linn. Soc., vii., 1899, p. 399, pl. xxxi.A; *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 553.

CHILTONIA AUSTRALIS, *Sayce.*

Hyalella australis, Sayce, Proc. Roy. Soc. Vict., xiii., 1901, p. 226, pl. xxxvi.; *Chiltonia australis*, Sayce, *ibid.*, xv., 1902, p. 47. *Id.*, Stebbing, Das Tierreich, xxi, 1906, p. 735.

CHILTONIA SUBTENUIS, *Sayce.*

Chiltonia subtenuis, Sayce, Proc. Roy. Soc. Vict., xv., 1902, p. 48, pl. iv. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 735.

NEOBULE GAIMARDII, *Milne-Edwards.*

Amphitoe gaimardii, Milne-Edwards, Hist. Nat. Crust., iii., 1840, p. 37. *Neobule algicola*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 255, pl. viii., fig. 4, a, b.; and *ibid.*, x., 1885, p. 96, pl. xi., figs. 4-6. *Neobule gaimardii*, Stebbing, Das Tierreich, xxi., 1906, p. 556.

HYALE MAROUBRÆ, *Stebbing.*

Hyale maroubræ, Stebbing, Trans. Linn. Soc., vii., 1899,p. 405, pl. xxxii.C; *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 563.

HYALE CRASSICORNIS, *Haswell.*

Allorchestes crassicornis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 252, pl. vii., fig. 5, a, b; and *ibid.*, x., 1885, p. 95, pl. x., figs. 2-5. *Hyale crassicornis*, Stebbing, Das Tierreich, xxi., 1906, p. 568.

HYALE NIGRA, *Haswell.*

Allorchestes niger, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 319; and *ibid.*, x., 1885, p. 96, pl. xi., figs. 1-3. *Hyale nigra*, Stebbing, Das Tierreich, xxi., 1906, p. 571.

HYALE RUPICOLA, *Haswell.*

Allorchestes rupicola, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 250, pl. viii., fig. 1, a, b; *ibid.*, x., 1885, p. 96, pl. x., figs. 9-12. *Id.*, Chilton, *ibid.*, ix., 1885, p. 1036. *Hyale rupicola*, Stebbing, Das Tierreich, xxi., 1906, p. 573.

HYALE, *sp.*, *Haswell.*

Allorchestes longicornis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 251, pl. vii., fig. 4, a, b ; *ibid.*, x., 1885, p. 95, pl. x., figs. 6-8. *Hyale*, sp., Stebbing, Das Tierreich, xxi., 1906, p. 574.

ALLORCHESTES COMPRESSUS, *Dana.*

Allorchestes compressa + *Allorchestes australis*, Dana, Proc. Amer. Acad., ii., 1852, pp. 205, 206. *Aspidophoreia diemenensis*, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 101, pl. vi., fig. 2, f. *Allorchestes compressus*, Stebbing, Das Tierreich, xxi., 1906, p. 581.

ALLORCHESTES HUMILIS, *Dana.*

Allorchestes humilis, Dana, Proc. Amer. Acad., ii., 1852, p. 206. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 584.

Family AORIDÆ.

AORA TYPICA, *Kröyer.*

Aora typica, Kröyer, Naturhist. Tidsskrift, (2), i., 1845, p. 328, pl. iii., fig. 3 a-l. *Microdeuteropus mortoni*, Haswell, and *Microdeuteropus tenuipes*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 339, pl. xxii., fig. 2f, 2g, and fig. 1, f-g. *Aora typica*, Stebbing, Das Tierreich, xxi., 1906, p. 587.

MICRODEUTOPUS HASWELLI, *Stebbing.*

Microdeuteropus chelifer, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 340, pl. xxii., fig. 3, f-g. *Microdeutopus haswelli*, Stebbing, Ann. Mag. Nat. Hist., (7), iii., 1889, p. 350; *Id.*, Das Tierreich, xxi., 1906, p. 591.

LEMBOS PHILACANTHUS, *Stebbing.*

See ante, p. 605.

LEMBOIDES AUSTRALIS, *Haswell.*

Microdeuteropus australis, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 271, pl. xi., fig. 5, a, b. *Lemboides australis*, Stebbing, Ann. Mag. Nat. Hist., (7), iii., 1899, p. 350 ; *Id.*, Das Tierreich, xxi., 1906, p. 601.

PARAOROIDES UNISTILUS, *gen. et sp.nov.*

See ante, p. 606.

XENOCHEIRA FASCIATA, *Haswell*

Xenocheira fasciata, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 272, pl. xi., fig. 6, a, b, c; *Ibid.*, x., 1885, p. 105. pl. xvi., figs. 1-3. *Id.*, Stebbing, Das Tierreich, xxi., p. 624, For transfer of this genus from the Photidæ to the Aoridæ, see Chevreux, Mém. Soc. Zool. France, xx., 1908, p. 515.

Family PHOTIDÆ.

PHOTIS BREVICAUDATA, *Stebbing.*

Photis brevicaudata, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1068, pl. cviii; *Id.*, Das Tierreich, xxi., 1906, p. 606.

PHOTIS DOLICHOMMATA, *sp.nov.*

See ante, p. 609.

CHEIRIPHOTIS AUSTRALIÆ, *sp.nov.*

See ante, p. 611.

HAPLOCHEIRA BARBIMANA, *G. M. Thomson.*

Gammarus barbimanus, G. M. Thomson, Trans. N. Zealand Inst., xi., 1879, p. 241, pl. x.D, fig. 1, a, b, c, d, e, f. *Haplocheira typica*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 273, pl. xi., fig. 2, a, b. *Haplocheira plumosa* + *Haplocheira barbimanus*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1172, pl. cxxvi., and p. 1177; *Haplocheira barbimana*, Stebbing, Das Tierreich, xxi., 1906, p. 609, figs. 104, 105. *Id*, A. O. Walker, Nat. Antarct. Exp., iii., 1907, p. 35.

EURYSTHEUS ATLANTICUS, *Stebbing.*

See ante, p. 614.

EURYSTHEUS CRASSIPES, *Haswell.*

Moera crassipes, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 103, pl. vii., fig 2, g, x. *Eurystheus crassipes*, Stebbing, Das Tierreich, xxi., 1906, p. 612.

EURYTHEUS THOMSONI, *Stebbing.*

See ante, p. 614.

EURYSTHEUS DENTIFER, *Haswell.*

Moera dentifera, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 332, pl. xx., fig. 4, f, g; ? *Moera approximans*, Haswell, *ibid.*, p. 334, pl. xxi., fig. 3f, 3g. *Eurystheus dentifer*, Stebbing, Das Tierreich, xxi., 1906, p. 615.

Family AMPITHOIDÆ.

AMPITHOE CINEREA. *Haswell.*

Amphithoë cinerea, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 269, pl. xi., fig. 4, a, b, and *Amphithoë grandimanus*, Haswell, *ibid.*, p. 270. *Ampithoe cinerea*, Stebbing, Das Tierreich, xvii., 1906, p. 634.

AMPITHOE QUADRIMANA, *Haswell.*

Amphithoë quadrimanus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 337, pl. xxi., fig. 7, f, g. *Ampithoe quadrimana*, Stebbing, Das Tierreich, xxi., 1906, p. 635.

AMPITHOE FLINDERSI, *Stebbing.*

See ante, p. 616.

AMPITHOE AUSTRALIENSIS, *Bate.*

Amphithoë australiensis, Bate, Cat. Amph. Brit. Mus., 1862, p. 237, pl. xli., fig. 7. *Ampithoe australiensis*, Stebbing, Das Tierreich, xxi., 1906, p. 641. An indeterminate species.

GRUBIA SETOSA, *Haswell.*

Amphithoë setosa, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 270. *Grubia setosa*, Stebbing, Das Tierreich, xxi., 1906, p. 614.

Family JASSIDÆ.

WYVILLEA LONGIMANA, *Haswell.*

Wyvillea longimanus, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 337, pl. xxii., fig. 7, g. *Wyvillea longimana*, Stebbing, Das Tierreich, xxi., 1906, p. 648.

JASSA PULCHELLA, *Leach.*

Jassa pulchella, Leach, Edinb. Encycl., vii., 1814, p. 433. *Cratophium validum*, Dana, Wilkes U.S. Expl. Exp. xiii., 1853, p. 841, pl. lvi., fig. 2. *Podocerus australis*, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 338, pl. xxi., fig. 8. *Jassa pulchella*, Stebbing, Das Tierreich, xxi., 1906, pp. 654, 739. This species from Watson's Bay was sent me some years ago by Mr. T. Whitelegge.

Family COROPHIIDÆ.

CERAPUS ABDITUS, *Templeton.*

See ante, p. 616.

SIPHONŒCETES AUSTRALIS, *sp.nov*

See ante, p. 619.

DRYOPOIDES WESTWOODI, *Stebbing.*

See ante, p. 621.

Family PODOCERIDÆ.

LÆTMATOPHILUS HYSTRIX, *Haswell.*

Cyrtophium ? hystrix, Haswell, Proc. Linn. Soc. N. S. Wales, v., 1880, p. 104, pl. vii., fig. 3, f, x; *Læmatophilus hystrix*, Haswell, *ibid.*, x., 1885, p. 110 *Lætmatophilus hystrix*, Stebbing, Das Tierreich, xxi., 1906, p. 697.

CYRTOPHIUM MINUTUM, *Haswell.*

Cyrtophium minutum, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 343, pl. xxii., fig. 6f, 6g; *Ibid.*, x., 1885, p. 109, pl. xviii., figs. 1-5, 9. *Id.*, Stebbing, Das Tierreich, xxi., 1906, p. 698.

LEIPSUROPUS PARASITICUS, *Haswell.*

Cyrtophium parasiticum, Haswell, Proc. Linn. Soc. N. S. Wales, iv., 1879, p. 274, pl. xii, fig. 1, a, a, b, x. *Leipsuropus parasiticus*, Stebbing, Das Tierreich, xxi., 1906, p. 699.

PODOCERUS INCONSPICUUS, *Stebbing.*

Platophium inconspicuum, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1194, pl. cxxxi.; *Podocerus inconspicuus*, Stebbing, Ann. Nat. Hist., (7), iii., 1899, p. 239; *Id.*, Stebbing, Das Tierreich, xxi, 1906, p. 702.

PODOCERUS LOBATUS, *Haswell.*

Dexiocerella lobata, Haswell, Proc. Linn. Soc. N. S. Wales, x., 1885, p. 110, pl. xviii., figs. 6-8. *Podocerus lobatus*, Stebbing, Das Tierreich, xxi., 1906, p. 703.

PODOCERUS LÆVIS, *Haswell.*

Dexiocerella lævis, Haswell, Proc. Linn. Soc. N. S. Wales, x., 1885, p. 111, pl. xviii., figs. 10-12. *Podocerus lævis*, Stebbing, Das Tierreich, xxi., 1906, p. 704.

PODOCERUS CRISTATUS, *G. M. Thomson.*

Cyrtophium cristatum, G. M. Thomson, Ann. Mag. Nat. Hist., (5), iv., 1879, p. 331, pl. xvi., figs. 9-15. *Cyrtophium dentatum*, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 342, pl. xx., fig. 5, f, g; *Dexiocerella dentata, ibid.*, x., 1885, p. 109, pl. xvii., figs. 8-12. *Podocerus cristatus*, Stebbing, Das Tierreich, xxi., 1906, p. 706.

PODOCERUS HYSTRIX, *sp.nov.*

See ante, p. 622.

ICILIUS AUSTRALIS, *Haswell.*

See ante, p. 627.

ICILIUS PUNCTATUS, *Haswell.*

See ante, p. 627.

ICILIUS DANÆ, *Stebbing.*

See ante, p. 626.

CAPRELLIDEA.

Family CAPRELLIDÆ.

PARAPROTO SPINOSA, *Haswell.*

Proto spinosa, Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 995, pl. xlix., fig. 1. *Paraproto spinosa*, Mayer, Siboga Exp., xxxiv., 1903, p. 25, pl. i., figs. 8, 9, pl. vi., figs. 16-19, pl. ix., figs. 7, 54.

PARAPROTO CONDYLATA, *Haswell.*

Proto condylata, Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 993, pl. xlviii., figs. 1-4. *Paraproto condylata*, Mayer, Siboga Exp., xxxiv., 1903, p. 25, pl. i., fig. 10, pl. vi., fig. 20.

METAPROTO NOVÆ-HOLLANDIÆ, *Haswell.*

Proto novæ-hollandiæ, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 275, pl. xii., fig. 3, a, b, c; *Id., ibid.*, ix., 1885,

p. 997; x., p. 111, pl. xviii., figs. 13-16. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1230. *Id.*, Mayer, Flora Fauna Neapel, xvii., 1890, p. 14; *Metaproto novæ-hollandiæ*, Mayer, Siboga Exp., xxxiv., 1903, p. 26, pl. i., figs. 11, 12, pl. vi., figs. 24-28, pl. ix., figs. 3, 50.

DODECAS HEXACENTRUM, *Mayer.*

Dodecas hexacentrum, Mayer, Siboga Exp., xxxiv., 1903, p. 29, pl. i., figs. 14, 15, pl. vi., figs. 33, 34.

DODECAS DECACENTRUM, *sp.nov.*

See ante, p. 629.

HIRCELLA CORNIGERA, *Haswell.*

Caprella cornigera, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 347, pl. xxiii., fig. 4, f, g, k. *Hircella cornigera*, Mayer and Haswell, *ibid.*, ix., 1885, p. 999. *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 31.

ORTHOPROTELLA AUSTRALIS, *Haswell.*

See ante, p. 632.

METAPROTELLA EXCENTRICA, *Mayer.*

Metaprotella excentrica, Mayer, Flora Fauna Neapel, xvii., 1890, p. 25, pl. i., figs. 20, 21, pl. iii., figs 30, 31, pl. v., fig. 22; *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 40.

METAPROTELLA HASWELLIANA, *Mayer.*

Protella haswelliana, Mayer, Flora Fauna Neapel, vi., 1882, p. 32, figs. in text 8-10; *Metaprotella haswelliana*, Mayer, *ibid.*, xvii., 1890, p. 24, pl. i., figs. 22, 23, pl. iii., figs. 28, 29, pl. v., figs. 23, 24, pl. vi., figs. 7, 23; *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 39.

PARADEUTELLA ECHINATA, *Haswell.*

Caprella echinata, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 346, pl. xxiii., fig. 2. *Protella echinata*, Mayer, Flora Fauna Neapel, vi., 1882, p. 32, figs. in text 6, 7. *Id.*, Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 998. *Paradeutella echinata*, Mayer, Flora Fauna Neapel, xvii., 1890, p. 30, pl. iii., figs. 42-44; *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 46.

PARACAPRELLA ALATA, *Mayer.*

Paracaprella alata, Mayer, Siboga Exp., xxxiv., 1903, p. 67, pl. ii., figs. 40, 41, pl. ix., fig. 73. From Broken Bay, 4 or 5 fathoms, sent to Dr. Mayer by Professor Haswell.

CAPRELLA TENUIS, *Haswell.*

Caprella tenuis, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 276, pl. xii., fig. 5, a. *Id.*, Mayer, Flora Fauna Neapel, vi., 1882, p. 71, left indeterminate. In Haswell's Revision of the Australian Læmodipoda (Proc. Linn. Soc. N.S. Wales, ix., 1885, p 993), this species is not mentioned.

CAPRELLA PENANTIS, *Leach.*

Caprella penantis, Leach, Edinb. Encycl., vii., 1814, p. 404. *Caprella acutifrons*, Latreille, Nouv. Dict. Hist. Nat., v., 1816. *Id.*, var. *neglecta*, Mayer, Siboga Exp., xxxiv., 1903, pp. 79, 80, 88, a specimen sent by Professor Haswell, from Port Jackson.

CAPRELLA EQUILIBRA, *Say.*

Caprella equilibra, Say, Journ. Acad. Nat. Sci. Philad., i., 1818, p. 391. *Caprella obesa*, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 348, pl. xxiv., fig. 1, f, k. *Caprella æquilibra*, Mayer, Flora Fauna Neapel, vi., 1882, p. 45. *Id.*, Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 999. *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 90.

CAPRELLA DANILEVSKII, *Czerniavski.*

Caprella danilevskii, Czerniavski, Mater. ad Zoogr. Pont., 1860, p. 92, pl. vi., figs. 21-34. *Caprella inermis*, Haswell, Proc. Linn. Soc. N.S. Wales, iv., 1879, p. 348, pl. xxiii., fig. 3, f, g; *Id.*, *ibid.*, ix., 1885, p. 1000. *Id.*, Mayer, Flora Fauna Neapel, vi., 1882, p. 71, figs. in text 26-29 (distinct from *C. inermis*, Grube, p. 53). *Caprella danilevskii*, Stebbing, Rep. Voy. Challenger, xxiv., p. 1264, pl. cxlv. *Id.*, Mayer, Flora Fauna Neapel, xvii., 1890, p. 58, pl. v., fig. 44, pl. vii., figs. 12, 13, 54; *Id.*, Mayer, Siboga Exp. xxxiv., 1903, p. 99.

CAPRELLA SCAURA, *Templeton.*

Caprella scaura, Templeton, Trans. Entom. Soc. London, i., 1836, p. 191, pl. xx., fig. 6. *Caprella attenuata*, Dana, Wilkes, U.S. Expl. Exp. xiii., 1852, p. 817, pl. lv., fig. 1, a-g. *Caprella scaura* and *Caprella attenuata*, Mayer, Flora Fauna Neapel,

vi., 1882, pp. 65, 67. *Caprella attenuata*, Haswell, Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 1000. *Caprella scaura*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1257, pl. cxliv. *Id.*, Mayer, Siboga Exp., xxxiv., 1903, p. 117, pl. v., figs. 13-18, pl. x., fig. 11.

HYPERIIDEA.

Family VIBILIIDÆ.

VIBILIA VIATOR, *Stebbing.*

Vibilia viator, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1286, pl. cxlviii.B, fig. E, perhaps identical with *Vibilia propinqua*, Stebbing, *ibid.*, p. 1279, pl. cxlvii. *Vibilia propinqua*, Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, Amphip., p. 124.

VIBILIA AUSTRALIS, *Stebbing.*

Vibilia australis, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1287, pl. cxlix. *Id.*, Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, Amphip., p. 124.

Family CYSTISOMATIDÆ.

CYSTISOMA LONGIPES, *Bovallius.*

Thaumatops longipes, Bovallius, Bihang K. Svensk. Vet. Ak. Handl., xi., 1886, No. 9, p. 13, figs. 15-23; *Id.*, K. Svensk. Vet. Ak. Handl. xxii., 1889, No. 7, p. 47, pl. iii., figs. 1-16. *Cystisoma longipes*, Stebbing, Rep. Voy. Challenger, xxix., 1888, pp. 575, 1334.

Family PHRONIMIDÆ.

PHRONIMA SEDENTARIA, *Forskål.*

Cancer sedentarius, Forskål, Descrip. Anim. in itin. orientali, 1775, p. 95. *Phronima sedentaria*, Stebbing, Rep. Voy. Challenger, xxix., p. 1357, pl. clxii.B. On this genus and species, see also Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, p. 1.

Family HYPERIIDÆ.

HYPERIA BENGALENSIS, *Giles.*

Lestrigonus bengalensis, Giles, Journ. Asiat. Soc. Bengal, lvi., 1887, p. 224, pl. vi., figs. 1-10. *Hyperia dysschistus*, Stebbing,

Rep. Voy. Challenger, xxix., 1888, p. 1388, pl. clxvii. *Id.*, Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 204. *Hyperia bengalensis*, A. A. Walker, Rep. Ceylon Pearl Fish., ii., 1904, p. 325.

EUTHEMISTO THOMSONI, *Stebbing.*

Themisto antarctica, G. M. Thomson (not *Id.*, Dana), Trans. N. Zealand Inst., xi., 1879, p. 243, pl. x, D, figs. 2, 3. *Euthemisto thomsoni*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1414, pls. clxxiv., clxxv. *Euthemisto antarctica*, Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 294 *Euthemisto gaudichaudii*, Bovallius, *ibid.*, p. 299. *Euthemisto compressa*, Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, pp. 81, 86.

EUTHEMISTO AUSTRALIS, *Stebbing.*

Euthemisto australis, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1417. *Id.*, Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 298. *Id.*, Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, p. 86. The later authorities cited consider this species indeterminate, and on the preceding species are not in agreement. The discussion is too intricate to be disentangled here, but Bovallius and Vosseler agree in suppressing the name *Euthemisto thomsoni*.

Family PHROSINIDÆ.

PHROSINA AUSTRALIS, *Stebbing.*

Phrosina australis, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1431. *Phrosina semilunata* (part), Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 426.

ANCHYLOMERA BLOSSEVILLII, *Milne-Edwards.*

Anchylomera blossevillii, Milne-Edwards, Ann. Sci. Nat., xx., 1830, p. 394. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1433, pl. clxxvii. *Anchylomera blossevillei*, Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 412, pl. xvii., figs. 1-22. *Id.*, Vosseler, Plankton Exp. Humboldt Stiftung, ii., 1901, p. 88, fig. 4 in text.

PRIMNO MACROPA, *Guérin.*

Primno macropa, Guérin, Magasin de Zoologie, vi., 1836, class 7, p. 4, pl. xvii., figs. 1a-1f. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1441, pl. clxxviii; *Primno latreillei*,

ibid., p. 1445, pl. clxxix.A ; *Primno menevillei, ibid.*, p. 1447, pl. clxxix.B. *Euprimno macropus*, Bovallius, K. Svensk. Vet. Ak. Handl., xxii., 1889, No. 7, p. 400, pl. xvii., figs. 23-40, pl. xviii., figs. 1, 2. *Id.*, Vosseler, Plankton Exp. Humboldt-Stiftung, ii., 1901, p. 87, pl. viii., fig. 21.

Family PHORCORRHAPHIDÆ.

PHORCORRHAPHIS EDWARDSI, *Stebbing.*

Phorcorrhaphis edwardsi, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1455, pl. clxxxi.

Family PLATYSCELIDÆ.

HEMITYPHIS TENUIMANUS, *Claus.*

Hemityphis tenuimanus, Claus, Die Gattungen und Arten der Platysceliden, 1879, p. 12. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1472, pl. clxxxiii.

TETRATHYRUS MONCŒURI, *Stebbing.*

Tetrathyrus moncœuri, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1480, pl. clxxxiv.

Family THYROPIDÆ.

This family name is adopted on the ground that *Thyropus*, Dana, appears to be the earliest genus in the family.

PARASCELUS PARVUS, *Claus.*

Parascelus parvus, Claus, Die Gattungen und Arten der Platysceliden, 1879, p. 20. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1500.

Family PRONOIDÆ.

EUPRONOË ATLANTICA, *Stebbing?*

Eupronoë atlantica, Stebbing? Rep. Voy. Challenger, xxix., 1888, pp. 1519, 1520.

PARAPRONOË CLAUSI, *Stebbing.*

Parapronoë clausi, Stebbing, Rep. Voy, Challenger, xxix., 1888, p. 1526, pl. cxc.

Family LYCÆIDÆ.

THAMNEUS PLATYRRHYNCHUS, *Stebbing.*

Thamneus platyrrhynchus, Stebbing, Rep. Voy. Challenger, xxix., p. 1558, pl. cxcviii.

PARALYCÆA GRACILIS, *Claus.*

Paralycœa gracilis, Claus, Die Gattungen und Arten der Platysceliden, 1879, p. 40. *Id.*, Stebbing, Rep. Voy. Challenger, xxix., 1888, p. 1568.

Family OXYCEPHALIDÆ.

STREETSIA OXYRHINGUS, *Prestandrea.*[14]

Orio oxyahingus, Prestandrea, Effem. Sci. Sicilia, vi., 1833, p. 10. *Oxycephalus porcellus*, Claus, Die Gattungen und Arten der Platysceliden, 1879, p. 48. *Id.*, Stebbing, Rep. Voy. Challenger, xxiv., p. 1587, pl. cciii. *Streetsia porcellus*, Bovallius, Oxycephalids, 1890, pp. 81, 83, pl. iv., figs. 4-6. *Streetsia porcella*, Senna, Bull. Soc. Entom. Italiana, xxxiv., 1902, p. 10. This species, taken by the "Challenger" between Api and Cape York, cannot perhaps strictly be counted as Australian, but the interesting identification by Dr. Angelo Senna is worth bringing under the notice of English readers. The name *Orio oxyrhingus*, Prestandrea, was mentioned in advance by Cocco, without description. The genus *Orio* falls to the earlier *Oxycephalus*, but in *Streetsia* the specific name *oxyrhingus* has priority and should be adopted.

Here it will be convenient to insert a notice of captures recorded by Mr. O. A. Sayce, in the *Victorian Naturalist*, xviii., No. 10, pp, 151-154, Feb. 6, 1902, under the heading "Dredging in Port Philip." At p. 181, he writes :—"Amphipoda—*Amaryllis macrophthalmus*, very common; *Phoxocephalus bassi*, *Moera rubromaculata*, *Liljeborgia haswelli*, several specimens of a new species of the genus Iphiplateia, and also *Icilius australis*. The two latter genera are remarkable in being much flattened and not compressed from side to side as nearly all the Amphipods are; the antennæ also of Iphiplateia are peculiar. We spent the night lying comfortably off Sorrento, and from the shore in the morning we collected some sandhoppers, which I find belong to a new species of Orchestia."

[14] By misprint OXYAHINGUS.

On p. 153 he writes:—"Amongst a large number of sessile-eyed crustaceans we may mention the following Amphipods—*Eusiroides cœsuris*, *Syrrhoe semiserrata*, *Atyloides australis*, *Elasmopus subcarinata*, *Autonoe philacantha*." On p. 154, after explaining that they stayed a night at St. Leonards, he writes:—"In the morning we went ashore and did some collecting. The sandhopper of the beach I found to be identical with *Talorchestia novæ-hollandiæ*, so far only recorded from New South Wales, but which I have also taken at Beaumaris, and have just lately received specimens collected by Mr. E. Ashby, from Brighton, South Australia."

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 13.

ALCYONARIA.

Published 27th January, 1911.

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THE

ALCYONARIANS OF THE "THETIS" EXPEDITION.

By PROFESSOR J. ARTHUR THOMSON, M.A.,

AND

MISS DORIS L. MACKINNON, B.Sc.

Carnegie Scholar, University of Aberdeen.

ALCYONARIA.

By J. Arthur Thomson and Doris L. Mackinnon.

(Plates lxi-lxxxii.)

The collection of Alcyonarians made by the "Thetis" includes thirty-five species, of which thirteen are new,—a large proportion. When the specimens are arranged in systematic order, it is seen at a glance that the collection has a very definite character, namely, the proportionately large number of Isidæ (*e.g.*, six species of *Mopsea*, four new) and of Primnoidæ (*e.g.*, five new species of *Plumarella*). These Isid and Primnoid colonies are extraordinarily beautiful, and their superficial resemblance to large fronds of Sertularians is striking. It is a matter for gratification that numerous specimens of some of the new species have been preserved, so that it was possible to make sure that one was not dealing with *individual* variations.

Another feature of the collection is the frequent occurrence of encrusting colonies of *Alcyonium (Erythropodium) membranaceum* and *A. reptans* described by Kükenthal, which grow over Gorgonid axes in a very misleading fashion. It is not too much to say that an unprejudiced observer, who had not seen the real state of affairs exposed in unmistakeable cases, would describe these Gorgonid axes encrusted with *Erythropodium* as peculiar Axifera.

LIST OF SPECIES [1].

Order I. STOLONIFERA, *Hickson.*

Family CORNULARIIDÆ.

Clavularia flava, Hickson.

Order II. ALCYONACEA, *Verrill* (pro. parte).

Family ALCYONIDÆ.

Alcyonium (Erythropodium) membranaceum, Kükenthal.
" " *reptans*, Kükenthal.
* " *etheridgei*, sp. nov.

[1] Those that are new are marked with an asterisk.

Family NEPHTHYIDÆ.

Lithophytum flabellum (Q.G.).
**Dendronephthya waitei*, sp. nov.

Order III. PSEUDAXONIA, *G. von Koch.*

Family MELITODIDÆ

Mopsella clavigera, Ridley.
„ *textiformis* (Lamarck)
Psilacabaria gracillima, Ridley.
Parisis australis, Wright and Studer

Order IV. AXIFERA, *G. von Koch.*

Family ISIDÆ.

Mopsea dichotoma (Linné).
„ *encrinula* (Lamarck).
* „ *australis*, sp. nov.
* „ *flabellum*, sp. nov.
* „ *elegans*, sp. nov.
* „ *whiteleggei*, sp. nov.
Acanthoisis flabellum, Wright and Studer.

Family PRIMNOIDÆ.

Stachyodes studeri, Versluys (*S. regularis*, Wright and Studer).
**Amphilaphis plumacea*, sp. nov.
**Plumarella lævis*, sp. nov.
* „ *thetis*, sp. nov.
* „ *corruscans*, sp. nov.
* „ *filicoides*, sp. nov.
* „ *versluysi*, sp. nov.
Primnoella australasiæ, Gray.
„ *flagellum*, Studer.
„ *distans*, Studer.
**Caligorgia laevis*, sp. nov.

Family GORGONIDÆ.

Leptogorgia, sp. (?)

Family GORGONELLIDÆ

Ctenocella pectinata (Pallas).

Order V. STELECHOTOKEA, *Bourne.*

Section ASIPHONACEA.

Family TELESTIDÆ.

Telesto trichostemma (Dana).
„ *arborea*, Wright and Studer.

Section PENNATULACEA.

Family KOPHOBELEMNONIDÆ.

Kophobelemnon schmeltzii(Kölliker), = *Sclerobelemnon schmeltzii*, Kölliker.

Family PTEROEIDIDÆ.

Godeffroyia elegans, Kölliker.
Sarcophyllum australe, Kölliker.

Of the thirty-five species in the collection, the following thirteen have been previously recorded from Australian seas:—

Clavularia flava, Hickson.
Mopsella clavigera, Ridley.
„ *textiformis* (Lamarck).
Psilacabaria gracillima, Ridley.
Parisis australis, Wright and Studer.
Mopsea dichotoma (Linné).
„ *encrinula* (Lamarck).
Acanthoisis flabellum, Wright and Studer.
Primnoella flagellum, Studer.
Primnoella australasiæ, Gray.
Ctenocella pectinata, Pallas.
Telesto trichostemma (Dana).
Sarcophyllum australe, Kölliker.

The most striking of the records of distribution are the following:—*Primnoella flagellum*, Studer, previously reported by Hickson from Australian seas, was originally found in the South Atlantic, off Patagonia; *Primnoella distans*, Studer, was previously found off the West Indies and Brazil; *Kophobelemnon schmeltzii* (Kölliker), was previously found off Formosa; *Godeffroyia elegans*, Kölliker, was previously recorded from the Gulf of Siam.

Order I. STOLONIFERA, *Hickson.*

Family CORNULARIIDÆ.

Genus CLAVULARIA, *Quoy and Gaimard.*

CLAVULARIA FLAVA, *Hickson.*

Clavularia flava, Hickson.—A Revision of the Genera of the Alcyonaria Stolonifera with a Description of one New Genus and several New Species. (Trans. Zool. Soc, xiii., 1894, p. 341, pl. l., figs, 12 and 13).

Clavularia flava, Hickson.—Preliminary Report on a Collection of Alcyonaria and Zoantharia from Port Philip. (Proc. Roy. Soc. Vict., (n.s.), ii., 1890, pp. 136-140).

A few small pieces of a *Clavularia* agree with Hickson's description of *C. flava.* The stolons are thin and ribbon-like; the cylindrical polyps, 3·5 mm. in height, with a diameter of about 1·5 mm., are separated from one another by rather wide intervals, 1-2·5 mm. The upper part of the polyp with the tentacles is retracted completely into the stout-walled, heavily-armoured lower portion. The spicules agree with those described by Hickson, but are flesh-pink instead of yellow. The colour of the colony is a deep salmon-pink.

Kükenthal[2] places *Clavularia flava,* Hickson in his amended genus *Anthelia.* His amended genus *Clavularia,* however, is separated from *Anthelia* by having a lower, non-retractile, calyx-like thick-walled portion, and an upper, retractile, thin-walled portion bearing the tentacles. As *Clavularia flava,* Hickson, answers this description, we think that Kükenthal is mistaken in seeking to remove it from its original position in the genus *Clavularia.*

Locality.—Between Port Jackson and Tuggerah.

Previously recorded from the coast of Victoria, shallow water.

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[2]Kükenthal—Alcyonacea—Wissenschaftliche Ergebnisse der Deutschen Tiefsee Expedition, xiii., 1906, p. 11.

Order II. ALCYONACEA, *Verrill* (pro parte).

Family ALCYONIDAE.

Genus ALCYONIUM, *Linnè.*

ALCYONIUM (ERYTHROPODIUM) MEMBRANACEUM *Kükenthal.*

Alcyonium membranaceum, Kükenthal, Alcyonacea—Wiss. Ergeb deutsch. Tiefsee Exped., xiii., 1, 1906, pp. 52-53, pl. 1., fig. 3, pl. ix., figs. 42-44.

Stations 42, 44, 34, 43, 47, 48.

Numerous Gorgonid axes, *e.g.* of *Ctenocella*, are almost covered by *Sympodium*-like growths, which investigation shows to be creeping Alcyonids, agreeing on the whole, with Kükenthal's description of *Alcyonium (Erythropodium) membranaceum*. The cœnenchyma-spicules are very variable in form. There are approximately spherical bodies (diameter ·08-·12 mm.), short thick cylinders with about two bands of thorny warts, forms like cervical vertebrae, and others of more irregular shape. The polyp spicules are spindles. Below the eight points of converging spicules in the anthocodia there is a deep collaret of about eight rows of horizontally disposed slender spindles. The colour of the colonies is light brown.

This species presents considerable difficulties to the classifier. In some specimens the Gorgonid axis is so completely and so evenly overgrown with the Alcyonid, that it is hard to believe that one is not dealing with the natural cœnenchyma. There is, however, a slight tendency to the formation of "independent stocks," and at the tips of the branches the encrustation often forms a well-marked projection beyond the axis. On the more weathered specimens it is instructive to note how the encrusting Alcyonid is brought up sharply against large groups of Cirripedes, Sponges, etc., which have also found the Gorgonid axis a suitable place of attachment.

In the majority of our specimens the internal structure could not be made out with certainty, owing to their being in the dried condition, and extremely friable. In the spirit-specimens, however, the cœnenchyma shows the Alcyonid arrangement of side-canals between the gastral cavities of the polyps, an arrangement that, in Kükenthal's opinion, removes these *Sympodium*-like

forms into the genus *Alcyonium*, where the sub-genus *Erythropodium* is designed for those that grow as membranous expansions.

Locality.—Eleven miles east of Broken Bay.

Previously recorded from 34°7'3" S. Lat., 24°59'3" E. Long., Francis Bay, 100 metres.

ALCYONIUM (ERYTHROPODIUM) REPTANS, *Kükenthal.*

(Pl. lxi., fig. i.)

Alcyonium reptans, Kükenthal, Alcyonacea—Wiss. Ergeb. deutsch. Tiefsee Exped., xiii., 1, 1906, pp. 53-54, pl. ii., fig. 9, pl. ix., figs. 45-49.

Stations 17, 34, 41, 42, 43, 44, 48, 53.

For 57 cm. of its entire length (83 cm.) the axis of a specimen of *Primnoella australasiae* is completely overgrown with a light chocolate-coloured, *Sympodium*-like Alcyonid, which agrees with Kükenthal's description of *Alcyonium (Erythropodium) reptans.* The same species covers a branched Gorgonid axis from which all trace of the original cœnenchyma has disappeared. Numerous smaller specimens also occur that show scarcely more than a fibrous residue of the Gorgonid axis which the *Sympodium*-like mass had originally made its support. Without the more complete specimens with which to make a comparison, these last forms would be very difficult of interpretation.

The spicules in every case are (1) slender spindles with few and simple warts, ·306 x ·084 mm.; ·27 x ·032 mm.; ·204 x ·017 mm.; (2) stouter, blunter spindles with more numerous, projecting tuberculate warts—·255 x ·068 mm.; ·238 x ·052 mm.; (3) flattened spindles with jagged and toothed margins—·323 x ·051.; ·289 x ·034 mm.; (4) a few irregular bodies—·085 x ·051 mm.

Locality.—Eleven miles E. by N. of Barrenjoey, 30-40 fathoms, rocks.

Previously recorded from the east side of Bouvet Island, 470 metres.

ALCYONIUM ETHERIDGEI, *sp. nov.*

(Pl. lxi., fig. 2 and 3; pl. lxii., fig. 3; pl. lxvii., fig. 4; pl. lxix.)

Stations 10, 17, 28, 31, 34, 41, 44.

This striking form is represented by numerous specimens. The largest colonies have the following dimensions.—Height and breadth in centimetres 7·5 x 8, 8·5 x 8·5., and 9·5 x 7., the smallest is ·5 cm. high by ·7 cm. broad.

Nearly all the specimens are complete. From a slightly encrusting base rises a stout stalk-portion, with a diameter, in the largest specimen, of 4·5 cm. This stalk is of very firm consistency, and has a rather harsh, wrinkled surface. The polyparium of the smallest specimen is unbranched and club-shaped. In all the others at a height of 2-3 cm. the stalk-portion divides up into a number of stout, diverging, finger-like lobes, 1-2 cm. in diameter. These subdivide into secondary lobes, usually from 0·5-1·75 cm. in height, with diameters ranging from 1 cm. to 1·75 cm. Upwards from a point about ·5-2 cm. from the base, the entire colony is covered with polyps which, in most of the specimens, are retracted into low, rounded, eight-lobed calyces. The average distance between two polyps is 1·5 mm. The polyps, when fully expanded, have a length of 3·5 mm. They are marked with eight longitudinal grooves, and just below the level of the tentacles they are armoured with eight isosceles triangles, each composed of 8-10 converging pairs of slender spicules. Near the base of each triangle these meet at an angle of about 45°; higher up, they are almost parallel; but very occasionally one or two are directed horizontally below the triangular points. The tentacles are entirely without spicules: they are long and feathery, with about ten long pinnules on each side of the middle line in a single row.

The whole surface of cœnenchyma appears as though dusted over with a thick sprinkling of small, white, glistening spicules, which bear a resemblance to grains of sugar. These are stout double-clubs and capstan-like bodies with a distinct "neck," and, on an average, two whorls of projecting, tuberculate warts. The following measurements were taken of length and breadth in millimetres:— ·187 x ·119; ·17 x ·119; ·119 x ·102; ·085 x ·085. Smaller forms (·102 x ·068 mm.; ·085 x ·051 mm.) approach Kölliker's "Sechser" and are probably young stages of the first. The entire cortex is crowded with spicules of the same form as those on the surface, and similar spicules occur, but much more sparingly in the canal walls.

The spicules of the polyps are spindles and clubs of slender form, with a few projecting warts. Their dimensions in mm. are ·306 x ·034; ·27 x ·068; ·204 x ·017; ·17 x ·017.

The colour of the colonies is greyish-brown to dark-brown; the polyps are a darker shade of the same colour.

In many respects this species comes very near to Hickson's *Alcyonium purpureum*[3].

[3]Hickson—The Alcyonaria of the Cape of Good Hope, part ii.—Marine Investigations in South Africa, iii., 1904, pp. 215-217, pl. vii., fig. 1, pl. ix., fig. 18.

Our species differs from Hickson's in the absence of the characteristic purple colour, the presence of a distinct stalk-portion, the sparser distribution of the polyps, the larger size of the polyp spicules, and the simpler character of the cœnenchyma spicules, the double-clubs in *Alcyonium purpureum* being figured with at least four whorls of warts. The powdered appearance of the surface of the cœnenchyma in our specimens is exceedingly characteristic.

Locality.—Manning Bight, 22 fathoms.

Family NEPHTHYIDAE.

Genus LITHOPHYTUM, *Forskal.*

LITHOPHYTUM FLABELLUM (Q.G.)

Lithophytum flabellum, Kükenthal, Versuch. einer Revision der Alcyonarien, ii. Die Familie der Nephthyiden, i. Theil. Zool. Jahrb., xix., 1903, p. 111.

A single catkin of this species was found among some broken fragments in the present collection.

Locality.—Coast of New South Wales.

Previously recorded from Zanzibar, Solomons, Tumbatu, New Ireland, Carteret Harbour, and Egmont.

Genus DENDRONEPHTHYA, *Kükenthal.*

(*Spongodes* in part).

DENDRONEPHTHYA WAITEI, *sp. nov.*

(Pl. lxii., fig. 4; Pl. lxv., fig. 2; Pl. lxvii., fig. 3.)

Station 25.

Several compact, bushy colonies, from 5 to 7 cm. in height, represent this interesting species. The specimens are all intact, and show great uniformity in their mode of growth. From a luxuriantly-rooting basal attachment rises a somewhat flaccid stalk, which just above the roots has a diameter of 10 mm., but swells out to 16 mm. higher up. At a height of about 2 cm. the stem is surrounded by foliaceous expansions bearing polyps along their edges. Above this, numerous small branches come off, and the stem finally divides into two main branches, which ramify extensively. The stem tends to be exposed on one side in its upper reaches, as there is a much sparser occurrence of branches on one side than on the other.

Over the branching side of the colony the polyp-bundles form a dense covering. The polyps occur in bundles of about six, in typically "glomerate" arrangement.

The polyp-stalks are very long, 1·5-2·5 mm. The polyp-heads are about 1·5 mm. and make an angle with their stalk that may be either a right angle or obtuse. The Stützbündel is very weakly developed; it consists of about four almost smooth spindles.

In contrast with the long polyp-stalk the Stützbündel seems quite inconspicuous, and this gives a *Stereacanthia*-like appearance to the polyp. The armature of the polyp consists of eight longitudinal rows of closely apposed pairs of curved spindles: there are about six to eight pairs in a row, of which the uppermost pair is the most strongly developed. One or both of this uppermost pair may project slightly above the polyp-head. Between the adjacent "points" thus formed, a few small spindles lie without regular arrangement. Unlike the spicules of the Stützbündel and polyp-stalk, which are yellow-brown smooth spindles with scarcely any warts, the spicules of the polyp-head are colourless, bent spindles, with more numerous, rather prominent warts. The following measurements were taken of length and breadth in millimetres:—(1) spicules of polyp-stalk, 1·37 x ·085; ·765 x ·035; ·425 x ·017; (2) polyp-spicules, ·765 x ·051; ·544 x ·034; ·34 x ·017; ·255 x ·025. There is a median row of very small, transversely-disposed spicules along each tentacle.

The spicules of the cortex are, in the upper part of the colony directed more or less transversely. They are long spindles (2·97 x ·17 mm.; 1·78 x ·19 mm.; 5·27 x ·34 mm.) with few, small warts. In the branches these superficial spindles are smaller, and take a longitudinal direction. Below the point where the ring of foliaceous branches comes off, the character of the cortical spiculation changes. There are still a few spindles, but the great majority of the spicules are small opaque, white stars, tri- and quadri-radiates and irregular spiny forms. ·204 x ·17 mm.; ·119 x ·102 mm.; ·102 x ·085 mm.

In the canal-walls of the lower part of the colony a few similar star-like spicules are to be found. In the upper reaches of the canal-walls no trace of spicules could be found.

The colour of the stem is brownish-gray with a reddish tinge on the branches; the roots are dark gray, and the polyps and their stalks are red-brown.

In certain features this species approaches very closely *Dendronephthya maxima*, Kükenthal, particularly in the form of the long-stalked polyps with their weakly-developed Stützbündel, and in the remarkable smoothness of the cortical spindles. But our species shows larger polyps, a greater number of spicule pairs in the longitudinal rows on the polyps, and these spicules are not smooth as in *D. maxima*, nor do they show any

tendency to form clubbed ends. Furthermore, the spicules on the tentacles are not arranged in a double row "en chevron." The spindles of the cortex are very much larger than in *D. maxima*; the stars and irregular spiny bodies of the base are similar in both species, but the canal-walls in our specimens do not show any of the numerous, disc-shaped concretions characteristic of *D. maxima*.

Order III. PSEUDAXONIA, *G. von Koch.*

Family MELITODIDAE.

Genus MOPSELLA, *Gray.*

MOPSELLA CLAVIGERA, *Ridley.*

(Plate lxviii., fig. 9.)

Stations 34, 40, 42 and 48.

Mopsella clavigera, Ridley, Report Zool. Coll. H.M.S. "Alert," 1884, p. 360, pl. xxxvii., fig. b. pl. xxxvii., figs. a-a^{iii}.

The largest specimens have lengths of 18 cm., 23·5 cm., 30 cm., and 53 cm. respectively. The branching is generally dichotomous, and is strictly in one plane. The branches arise from the nodes, which are very markedly swollen. In the largest specimens they have a diameter of as much as 18 mm. There is no anastomosis.

The polyps are chiefly confined to one surface, over which they are disposed irregularly in slightly projecting verrucæ. Into these the polyps are in the most cases retracted. The polyp armature consists of eight triangular points of three or four converging pairs of delicate spindles; below these are about two rows of similar spicules disposed horizontally. A double row of minute spicules, "en chevron," occurs along the middle line of each tentacle.

The spicules of the cœnenchyma are exactly like those described by Ridley, *i.e.*—(1) orange-coloured fusiform shapes, rather coarsely tuberculate, swollen, tapering, with occasional "Blattkeulen" at one end—·18 x ·034 mm.; ·15 x ·035 mm. (2) "Blattkeulen" of lemon-yellow colour, in shape like small pointed trowels, with a short handle, and a blade formed of about two lancet shaped laminæ—·07 6 x ·034 mm.; ·051 x ·032 mm.; ·042 x ·025.

With regard to the distribution of the cœnenchyma spicules, it may be remarked that the orange-coloured spindles generally

form the lower stratum, over the surface of which the yellow clubs are disposed in a thin layer, which may cover the entire colony, or may be confined to a broad circle round each polyp-opening.

Locality.—Eleven miles east of Broken Bay, 30-40 fms.

Previously recorded from Port Curtis, Queensland, 5-11 fms., Port Molle, 14 fms., Thursday Island, Torres Straits, 4-6 fms.; Dirk Hartog Island, West Australia (Studer).

MOPSELLA TEXTIFORMIS, *Lamarck.*

(Plate lxiii., figs. 4 and 5.)

Mopsella textiformis, Ridley, Report Zool. Coll. H.M.S. "Alert," 1884, pp. 358-360.

The strong basal portion of what must have been a large colony. It is about 23 cm. in height, and the diameter near the base is as much as 3 cm. The length of the inter-nodes varies from 4 to 9 mm., and of the nodes 4-6 mm. The colour of the axis is rose. At the base where it is weathered and the longitudinal canals are exposed, the axis has a very remarkable labyrinthine pattern. The main stem gives off several strong branches in one plane, and these seem to have given off numerous secondary branches strikingly slender in contrast. There has been abundant anastomosis. Most of the cœnenchyma has been worn off, but here and there patches remain of a bright yellow colour. In regard to spicules the specimen agrees well with Ridley's description, but very few of the characteristic dentate "Blattkeulen" have long shafts. In these spicules the shafts are usually orange and the heads lemon-yellow. The nodes contain the usual smooth rods.

Locality.—Lord Howe Island.

Previously recorded from many Australasian Stations.

Genus PSILACABARIA, *Ridley.*

PSILACABARIA GRACILLIMA, *Ridley.*

Psilacabaria gracillima, Ridley, Rep. Zool. Coll. H.M.S. "Alert," 1884, pp. 364-365, pl. xxxvii., figs. d-d[11], pl. xxxviii., figs. f-f[11].

Stations 34, 36, 48

A number of broken pieces seem referable to *Psilacabaria gracillima*, Ridley. The chief characteristics of this species may

be summarised :—dichotomous branching approximately at right angles and in one plane ; absence of anastomosis ; the axis of the internodes hard, white, not striated ; low, rounded, tubercular polyps arranged in a rather irregular manner, in spirals, and opposite ; chief forms of spicules.—(1) large cylinders (·28 to ·31 x ·087 mm.), fusiform to sub-clavate, with thick axis, slightly tapering to round-pointed ends, provided with strong tubercles with tendency to arrangement in whorls ; (2) smaller spindles (·21 to ·25 x ·053 to ·071 mm.), more or less curved, with sharp ends and roughened tubercles.

The colour of the specimens is yellowish-brown.

Locality.—South Coast of New South Wales.

Previously recorded from Port Molle, Queensland, 12-30 fathoms ; Port Darwin, 8-12 fathoms ; East Australia, 42 fathoms

Genus PARISIS, *Verrill.*

PARISIS AUSTRALIS, *Wright and Studer.*

(Plate lxx.)

Parisis australis, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 183-184, pl. xli., fig. 5.

Stations 13, 34, 44, 47, 48.

This species was founded on two fragments, much overgrown by an encrusting sponge. In the present collection there are numerous specimens, many of them almost entire, so that we are able to amplify the original description.

The largest colony is 35 cm. high, with a spread of 18 cm. From a slightly encrusting calcareous base arises the cylindrical stem, with an average diameter of 6 mm. which soon begins to give off branches. These arise on the sides, alternately and in one plane.

Higher up all distinction between main stem and branches is lost. The upper part of the colony consists of a close tangle of equal sized branches, 3-3·5 mm. in diameter, which divide dichotomously or give off short branches quite irregularly, but invariably in one plane. The tendency is for all the branches to bend upwards at the tip, and the axillary angle is 45°-60°. Though the branches often overlap one another, or even entwine slightly, there is never any anastomosis.

The surface of all the colonies is more or less encrusted with a siliceous sponge, which often entirely obscures the underlying structure, and produces by its numerous projecting spicules a curious brown, velvety surface. Beneath this is the hard pavement-like surface-layer of the *Parisis*, consisting of cream-white cœnenchyma spicules.

In the lower part of the stem the calcareous and horny joints have approximately equal lengths of about 2·5 mm.; but higher up the internodes greatly predominate, 3-4 mm., while the nodes are reduced to mere constrictions, ·5 mm. in length. The internodes are white, and bear somewhat distant longitudinal grooves.

On the younger colonies and smaller branches the arrangement of the polyps is bilateral, but on the larger branches they may occur all round. In one specimen where they were less obscured by sponge-growth than elsewhere, the polyps had a height of ·75 mm. with a diameter of 1 mm.; they projected from the branch as low, rounded warts.

The spicules are exactly like those described by Wright and Studer—*i.e.*, massive warty spindles, some almost as broad as long, and approaching spheres. The warts are high and prominent and finely sculptured. The following measurements were taken of length and breadth in millimetres.—·261 x ·17; ·25 x ·1; ·2 x ·16; ·17 x ·1.

This species is distinguished from *Parisis fruticosa*, Verrill—(1) by the branches coming off at angles of 45°-60°, instead of at approximately right angles; (2) by the polyps occurring all round the branches instead of being strictly bilateral; (3) by the smaller size, and greater slenderness of the spicules.

Locality.—South Coast, New South Wales.

Previously recorded from Station 163 B, off Port Jackson, 35 fathoms.

Order IV. AXIFERA, *G. von Koch.*

Family ISIDAE.

Genus MOPSEA, *Lamouroux.*

MOPSEA DICHOTOMA, *Linné.*

(Plate lxvii. fig. 1.)

Morpsea dichotoma, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 41-42, pl. ix., fig. 10.

Stations 48, 47. 53.

The largest specimen is an almost complete lyre-shaped colony, rising from a slightly encrusting calcareous base to a height of 22·5 cm. The main stem, 3 mm. in diameter near the base, divides to form two equal branches at a height of 2·5 cm. These two main branches give rise along one side to a number of

secondary branches which run parallel to one another. As these secondary branches are nearly as thick as the main branch from which they spring, the effect of a repeated dichotomy is produced, an effect that is heightened by the tendency of the main branch to bend outwards after each branch is given off, so that its course describes a series of shallow curves. The secondary branches rise straight upwards and may remain unbranched throughout their length, or may divide dichotomously. Branching is strictly in one plane.

The polyps are arranged in close spirals all over the larger colonies, though one young specimen shows the polyps in a single alternating row on each side of the branch.

The polyps are club-shaped, with truncated mouths; they are directed upwards, and bent towards the stem. In the largest specimen the upper parts of the polyps have all been rubbed off, which produces a deceptive appearance of very short, truncate polyps with their mouths directed outwards from the stem.

There is a considerable variety in the spicules (Pl. lxvii. fig. 1).

(1) There are somewhat flattened, curved spindles, produced on the convex side into a number of sharp, prominent teeth. The following measurements were taken of length and breadth in millimetres.—·238 x ·102; ·187 x ·085; ·118 x ·068; ·102 x ·051.

(2) Spicules of similar form to (1), but simpler and with only a few small warts.—·153 x ·051; ·136 x ·053; ·102 x ·034 mm.

(3) Small "Blattkeulen" with a very small shaft, bearing sometimes a few warts, and supporting a group of sharp, blade-like projections.—·102 x ·085; ·09 x ·068; ·051 x ·032 mm.

(4) Small irregular bodies and "capstans."—·085 x ·085; ·102 x 0·85; 0·68 x 0·51 mm.

The colour of the colonies is pale-brown to cream.

Previously recorded from the Indian Ocean, and Port Jackson, New South Wales, 35 fathoms.

MOPSEA ENCRINULA, *Lamarck.*

Mopsea encrinula, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 43-44, pl. vii., figs. 1, 1ª, 1ᵇ., pl. ix., fig 11.

Stations 34, 44, 47.

A few incomplete specimens in the present collection agree closely with the description of *Mopsea encrinula* (Lamarck), given by Wright and Studer. Branching is plume-like in one plane; the club-shaped polyps, 1 mm. long, cover the branches and twigs in a close spiral, and are incurved towards the stem. Many of the spicules are yellow and white flattened spindles, approaching the "lancet-shaped plates" of Wright and Studer's description.

These bear numerous high, projecting warts, which tend to be more numerous towards one side of the spicule than the other, especially if the spicule is curved, when the convex side is always much the stronger toothed ; length by breadth in mm. ·187 x ·051 ; ·15 x ·06 ; ·12 x ·05. There are also scales with very irregular margins and numerous spiny warts.—·102 x ·082 mm. ; ·063 x ·04 mm. ; ·02 x ·02 mm. Thirdly, there are small irregular bodies.—·025 x ·025 ; ·051 x ·025.

The colour of the specimens is orange-brown ; the polyps yellowish-white.

Locality.—Eleven miles east of Broken Bay.

Previously recorded from Australia (North-west Coast), 50 fathoms ; Station 162, off East Moncoeur Island, Bass Strait, 38 fathoms.

MOPSEA AUSTRALIS, *sp. nov.*

(Plate lxiv. figs. 1 and 2., pl. lxvii. fig. 5.)

One specimen has the basal portion almost intact, the others are broken, branching pieces of various lengths. All are in the dried condition. The mode of branching, and, in fact, the whole general appearance of the colony is very similar to *Mopsea dichotoma* (Linné).

The polyps are arranged in close spirals round the branches. They are small (·5-·75 mm. in length), club-shaped, and, in the dry state at any rate, are very closely pressed to the surface of the branch, so that their mouths are hidden. Their armature consists of indistinct longitudinal rows of transversely arranged, slightly overlapping spicules ; there are from fifteen to eighteen of these in the abaxial rows.

The spicules of this species are smaller than those of *M. dichotoma*, and much less spiny. The following types occur—(1) rather broad, flattened, almost scale-like spicules with relatively prominent teeth round their edges, and with a few warts over the surface. These spicules vary in shape from flattened spindles to rough ∞-shapes and ovals. The following measurements were taken of length and breadth in millimetres.—·187 x ·034 ; ·153 x ·068 ; ·119 x ·051 ; ·102 x ·068. (2) Stout spindles and some clubs with prominent warts.—·153 x ·034 mm. ; ·119 x ·017 mm. ; ·102 x ·017 mm. (3) Capstans and small, irregular bodies.—·051 x ·034 mm. ; ·034 x ·034 mm. ; ·068 x ·017 mm. ; ·034 x ·017 mm.

The colour of the dried specimens is deep cream.

It must be admitted that *Mopsea dichotoma* (Linné), *M. elongata*, Roule, and the species at present under discussion, are

very closely related. The only noteworthy difference, as it seems to us, lies in the character of the spicules. Roule lays emphasis on the mode of branching, which he finds to be more sparse in *M. elongata* than in *M. dichotoma,* and with a strong tendency to the formation of long, simple branches. Our new species, *M. australis,* agrees with Roule's description of the branching of *M. elongata,* but it also agrees with the undoubted specimens of *M. dichotoma* in the present collection—so closely, indeed, that it was at first mistaken for that species. We do not think that the mode of branching can here be safely used as a specific distinction. Perhaps the same is true in regard to the details of spicule-form.

Locality.—Eleven miles east of Broken Bay.

MOPSEA FLABELLUM, *sp. nov.*

(Plate lxiii. figs. 1-3 ; pl. lxvii. fig. 6 ; pl. lxxi.)

Stations 34, 44.

This species is based on one complete colony and a number of pieces.

The complete specimen rises from a slightly encrusting calcareous base to a height of 24·5 cm. Branching begins at a height of 5·5 cm. and is very luxuriant ; the branches are confined almost exclusively to one plane, and there is a strong tendency to dichotomy ; they are slender throughout, and do not taper much ; the stouter branches have a diameter 2·5 mm., and the twigs of almost 2 mm., near their tips.

Near the base the diameter of the axis is 4 mm. Here the cœnenchyma has been worn off, and the bulk of the stem is made up of the horny joints which are about 2 mm. long, the calcareous joints being reduced to ·75 mm. ; in some cases they are quite overlapped by the horny joints. Higher up the calcareous joints have lengths of 3-4 mm., and the horny joints ·25-·5 mm. The colour of the horny joints is brown ; that of the calcareous joints varies from cream-white near the base of the colony to orange in the twigs. The calcareous joints bear marked longitudinal flutings. The branches arise from the calcareous joints.

The polyps occur in close-wound spirals all over the stem and branches. In the youngest twigs the spiral is wider but nowhere is there any trace of a bilateral arrangement. The polyps are club-shaped, with somewhat truncate mouths which are pressed against the cortex of the branch. The average length of a polyp is 1 mm. The calyces are armoured with about eight rather indefinite longitudinal rows of overlapping spicules,

fifteen to eighteen in a row. These spicules are flat, yellow scales, circular, 8-shaped and irregular; they are smooth, or bear a few simple warts, and their margins are deeply dentate or serrate. Their dimensions in millimetres are, ·255 x ·136; ·204 x ·102; ·17 x ·068; ·153 x ·153. A low eight-rayed operculum is formed by similar scales.

The spicules of the cœnenchyma are yellow spindles and cylinders (·187 x ·035; .17 x ·017; ·136 x ·051 mm.). They have relatively few, but large warts. There are also small irregular bodies (·085 x ·051; ·051 x ·034; ·068 x ·05 mm.).

The general colour of the colony is orange-brown, the polyps are rather lighter.

MOPSEA ELEGANS, *sp. nov.*

(Plate lxiv. figs. 3 and 4; pl. lxviii. fig. 5; pl. lxxii.)

Stations 34, 41, 42, 47, 48.

Several beautiful golden-brown colonies, with rich dichotomous, almost parallel, branching. The largest is 34 cm. in height, with a spread of about 5 cm.; the branches have an average diameter of 2 mm. The axis shows the usual white calcareous internodes with fine longitudinal fluting and short amber-coloured nodes.

There is some variety in the origin of the branches. In certain cases the dichotomy is precisely at the node; in other cases the calcareous internode forms immediately below the node a slight shelf from which a new branch arises with a horny node as the first joint. The cœnenchyma is very thin, and, with the exception of a median line on each surface, is in great part hidden by the numerous polyps. These occur in alternating rows on each side, here and there encroaching on the free median spaces. Most of the branches show two rows on each side in their upper reaches, but in the lower parts of the colony three or four rows are often seen. The polyps are somewhat club-shaped, 0·75-1 mm. in height by about 0·5 mm. in maximum breadth. They project at an acute angle to the axis, but the upper parts are incurved. In the upper reaches there are about twenty on each side in a centimetre.

The superficial spicules are flat, often oval scales, with the following dimensions in millimetres.—·073 x ·066; ·052 x ·052; 0·38 x 0·55. Each scale shows a nucleus, often excentric, with fine ridges radiating from it. One margin of the scale is entire, the other bears more or less deep indentations, and the part of the scale to this side of the nucleus is studded with small warts. The whole might be compared to a ctenoid fish-scale, and they overlap one another, the overlapped part being the smooth portion.

Under low power the polyps present a characteristic punctate appearance, due to the conspicuous nuclei of the scales. The imbrication is well seen on a profile view of the polyps. Besides the scales there are short stout capstan-like bodies (·066 x ·031 ; ·042 x ·038 ; ·038 x ·031), with hardly any definite waist, with a knob at each end, and with about six pointed tubercles on each side of the middle line. They correspond closely to Kölliker's "Sechser."

The characteristic features of this new species are its dichotomous sub-parallel branching, the arrangement of the polyps in two alternating rows on each side of the younger branches, and the combination of superficial ctenoid scales with deeper tuberculate capstans.

There are many features in common between this species and two others which have been previously recorded from Australian seas, but it appears to be quite distinct. To mention only two features, we note that our new species may be readily distinguished from *Mopsea dichotoma* (Linné), which has been described in detail by Wright and Studer[4], by the quite different spicules; and from *M. encrinula* (Lamarck), also described by Wright and Studer[5], by the pinnate branching.

Ehrenberg's *Mopsea erythraea*[6] belongs not to *Mopsea* but to *Wrightella* or to *Melithaea*.

Pourtales's *Mopsea eburnea*[7] had eight spicules projecting from the mouth of the polyps, and cannot be included in this genus.

MOPSEA WHITELEGGEI, *sp. nov.*

(Plate lxvi., figs. 2 and 3 ; pl. lxxiii.)

Stations 10, 40, 44, 48.

This exceedingly delicate and graceful form is typically plume-like in its mode of growth ; all branching is in one plane. Both the secondary branches, and the main branches from which they spring, bear numerous slender twigs disposed on each side like the barbs of a feather along the shaft. The calcareous nodes give rise to one twig each, on opposite sides of the branch in alternate succession. A few of the twigs branch again in the same manner. The average distance between two twigs is 1 mm.

The largest specimen is 23 cm. high with a span of 17·5 cm. across its luxuriantly branched upper portion. The basal portion

[4] Wright and Studer—Chall. Rep., Zool, xxxi., 1889, p 41, pl. ix., fig. 10.

[5] Wright and Studer—*Loc. cit.* p. 43, pl. vii., figs. 1, 1 , 1 ; pl. ix., fig. 11.

[6] Klunzinger—Korallenthiere des Rothen Meeres, 1887, p 57, pl. vi., fig. 4, 4^a, 4^d.

[7] Pourtales—Bull. Mus. Comp. Zool. Harvard, i., 1868, p. 132.

of the stem is missing. The stem has a maximum diameter of 4 mm.; the average diameter of the larger branches is 2 mm., and of the twigs, 1 mm. Another specimen, also incomplete, has a height of 16 cm., with a span of 11 cm. The lower part of the stem is overgrown by a sponge.

Polyps occur here and there on the branches, but they are mainly confined to the twigs, along each side of which they are arranged alternately in a single row. Frequently this arrangement becomes irregular, the polyps encroach on the middle line, or a double row may be formed along each side. There are about fifteen polyps to 1 cm. in each row.

The polyps are small, ·5-·75 mm. in height, club-shaped, truncate, and turned upwards towards the tip of the twig. They are covered with closely-fitting, elongated spicules arranged transversely, which either interlock by means of their dentate margins, or overlap one another; the abaxial rows are composed of about sixteen such spicules arranged in an imbricate manner. Similar spicules form a low, eight-rayed operculum. The spicules of the cœnenchyma are like those of the polyps, but follow the longitudinal direction of the stalk and form a sort of pavement over its surface, adjacent spicules being closely interlocked by their teeth. The calcareous internodes of the axis bear fine longitudinal ridges, which are dentate at the upper and lower ends of the joint. The spicules are small, colourless, somewhat flattened spindles and lancet-shaped plates, frequently curved, and bearing numerous sharp, tooth-like warts, which are usually more strongly developed on one side of the spicule than the other. The following measurements were taken of length and breadth in millimetres:—·238 x ·085; ·17 x ·068; ·136 x ·051.

There are also numerous smaller spindles and forms approaching clubs:—·153 x ·025; ·112 x ·035; ·085 x ·034; ·068 x ·017 mm.

The colour of the colonies is pale-brown to cream-white, the axis occasionally tinged with pink.

Locality.—Eleven miles east of Broken Bay.

Genus ACANTHOISIS, *Wright and Studer.*

ACANTHOISIS FLABELLUM, *Wright and Studer.*

(Plate lxii., figs. 1 and 2.)

Acanthoisis flabellum, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 45-46, pl. viii., figs. 1, 1a., 1b., pl. ix., fig. 12.

Stations 22, 47 and 53.

Some very fine fan-shaped specimens of an orange-brown colour agree with Wright and Studer's description of *Acanthoisis*

flabellum, though there appears to be a stronger tendency to anastomosis than in the Challenger specimens. The height of the largest colony is 24 cm., with a width of 16 cm. across the expanded portion.

A small, broken piece of a colony is of a brown colour with the polyps tending to encroach on the middle line of the branch instead of being strictly bilateral in arrangement. The spicules here are colourless, and rather smaller than in the orange specimens.

Previously recorded from Port Jackson, 30-35 fathoms.

Family PRIMNOIDÆ.

Genus STACHYODES, *Wright and Studer.*

STACHYODES STUDERI, *Versluys.*

Stachyodes regularis, Wright and Studer, Chall. Rep., Zool., xxxi. 1889, p. 55, pl. xi., figs. 2, 2ª; pl. xx, fig. 3.

Stachyodes studeri, Versluys, Die Gorgoniden der Siboga Expedition, ii. Die Primnoidæ, 1906, pp. 94-96, figs. 112-117.

Stations 15, 42, and 44.

Three incomplete specimens 11 cm., 23 cm. and 38 cm. in length respectively. On the most slender specimen the polyps occur in whorls of eight to nine; on the largest there are as many as ten to eleven in a whorl.

Previously recorded from Kermadec Islands, 600 fathoms; Celebes Sea (Siboga), 1080 and 1165-1264 M.

Genus AMPHILAPHIS, *Wright and Studer.*

AMPHILAPHIS PLUMACEA, *sp. nov.*

(Plate lxv., fig. 3; pl. lxviii., fig. 3; pl. lxxiv.)

Stations 22, 40, 44.

This delicate and graceful form bears a certain resemblance to an uncurled ostrich plume. Branching is approximately in one plane, and the branches and twigs show a strong tendency to sweep together in long, drooping curves. Occasionally the branches come off like the barbs along the shaft of a feather, but more generally the branching is dichotomous, or quite irregular.

Three of the four specimens are practically intact. The largest has a height of 18·5 cm. with a diameter near the base of 3 mm., the corresponding dimensions of the smallest are 8·5 cm. and 2 mm.

The cœnchyma is very thin, and allows the dark, bronze-like axis to shine through.

The polyps occur very rarely in two lateral rows; generally they are arranged in a spiral, which becomes closer in the upper part of the colony.

The polyps are 1-1·5 mm. in length. They stand out markedly from the branch at an angle of 45°-60°. They are armoured with eight close-set longitudinal rows of overlapping "ctenoid" scales; there are from eight to twelve in a row on the abaxial side, and a rather smaller number on the adaxial. The uppermost scale of each row is more strongly developed than the rest, and its upper edge is somewhat reflexed, so that it stands out from the operculum. In this way a sort of collar or circum-operculum is formed. Above this eight triangular scales form a well-defined, conical operculum.

The dimensions of the "ctenoid" scales in millimetres are ·316 x ·181; ·255 x ·272; ·204 x ·153. Their free edge is entire or crisply waved; around the well-marked nucleus numerous warts are grouped, and the clear border round the exposed portion of the scale bears strongly-marked radiating ridges.

The opercular scales are isosceles triangles with a strong concavity to the outer surface, and a corresponding ridge internally, which extends for about three-quarters the length of the scale. The surface is elaborately warted, and the narrow clear margin bears ridges. The following measurements were taken of length and breadth in millimetres.—·415 x ·204; ·34 x ·221.

The spicules of the cœnenchyma are approximately circular scales, with a central nucleus, round which warts are grouped. The border is clear, with at most a few low ridges (·187 x ·17 mm.; ·136 x ·119 m.m.; ·112 x ·112 mm.).

The colour of the specimens is fawn to brown.

This species differs from *Amphilaphis regularis*, Wright and Studer, in the following points:—(1) its much more slender build, and bushier, more luxuriant branching; (2) the almost invariable arrangement of the polyps in spirals, and their much denser crowding; (3) the smaller size of the polyps, and (4) the greater number of scales in the abaxial rows of the calyx.

From *Amphilaphis abietina*, Studer, it is distinguished:—(1) by the close spiral arrangement of the polyps; and (2) by showing no tendency for the branches to come off at right angles from the stem.

Locality.—Eleven miles E. by N. of Barrenjoey, 30-40 fathoms.

Genus PLUMARELLA, *Gray.*

PLUMARELLA LÆVIS, *sp. nov.*

(Plate lxvi., fig 1 ; pl. lxviii., fig. 4 ; pl. lxxv.)

Stations 44, 47, 48.

A number of incomplete branching pieces, and two complete colonies, of which the larger is 38 cm. high, with a width of 42 cm. across the branched portion. Branching is strictly confined to one plane. From the main branches lesser branches are given off alternately from each side at rather wide intervals ; these branches bear long, slender, relatively sparse twigs, alternating in a single row along each side, about five to six on each side in a stretch of 5 cm. These twigs are from 3-7 cm. long, with an average diameter of 1 mm. ; they either fork dichotomously or bear a few scattered twigs.

The axis is furrowed, and of a dull yellow colour, with a gold sheen in the upper portions of the colony. The cœnenchyma is very thin ; in the lower part of the colony the furrows on the axis show plainly through it. One strongly-marked furrow can be traced on both faces of the colony along the median line of every branch, down to the finest ramifications.

The polyps alternate in a single row along each side of the twigs and lesser branches. There are ten to twelve on each side in a length of 1 cm. They are small, ·5-·75 mm. in length, with truncated mouths directed distally.

The spicules are small, colourless and pale yellow scales of characteristically simple form. The majority are ovals or ∞ shapes, and irregular forms. Their margins are entire or minutely dentate, and their surfaces are either quite smooth, or bear only a few small scattered warts. The following measurements were taken of length and breadth in millimetres :—·171 x ·032 ; ·112 x ·058 ; ·102 x ·038 ; ·077 x ·024 ; ·058 x ·021. These spicules interlock or overlap one another slightly ; on the polyp they are arranged transversely, but the eight longitudinal rows are not very distinct. The operculum is low and flat.

The colour of the colony is dull yellow to golden-brown.

Position — In certain respects this species comes very near *Plumarellapenna* (Lamarck), as described by Versluys[8]. The polyps are very similar, and the spicules have a strong resemblance. But, on the whole, the spicules of our specimen

[8] Versluys—Die Gorgoniden der Siboga Expedition, ii. Die Primnoidæ, 1906, p. 18.

are smaller than those described for *P. penna*, and are smoother and of more simple outline. The chief point of difference, however, lies in the mode of branching, which in *P. penna* is close and typically feather-like. Versluys speaks of as many as twenty-three twigs on each side of a branch in a stretch of 5 cm.; these twigs, moreover, are never longer than 3 cm. and are always unbranched.

Locality.—Eleven miles east of Broken Bay.

PLUMARELLA THETIS, *sp. nov.*

(Plate lxvi., fig. 5; pl. lxviii., fig. 6; pl. lxxvi.)

Stations 34, 40, 42, 47, 48, 53.

This handsome new species is well represented by dried specimens; two small pieces are preserved in spirit.

The colonies are typically feather-like. The long, frond-like branches bear on each side a row of alternating twigs. These twigs occasionally branch in the same pinnate manner, but usually remain simple. The polyps rarely occur on two sides of the twigs; usually they are arranged all over the twigs in close spirals. On the larger branches they may be confined to two sides, or they may be scattered indefinitely over the whole surface.

None of the specimens show the basal portion. The most richly-branched colony has a height of 32 cm., with a width of 53 cm. The stem has a diameter of 5 mm. The twigs average 3-4·5 cm. in length, with a diameter of 2 mm. There are about fourteen twigs on each side in a length of 5 cms.

Some of the colonies are much more heavily built. A single frond is 43 cm. long, with a diameter of 5·5 mm. at the base. The twigs in this case are 8-10 cm. long, with a diameter of 2-3 mm., and only seven to eight occur in each row in a length of 5 cm.

The polyps are very closely crowded over the twigs. Their average length is 1 mm. The calyx scales are arranged in longitudinal rows, of which the abaxials alone are complete. These consist of about six relatively large, overlapping scales. The adaxial rows are reduced to about one small scale, and the adaxial-laterals are also very few in number and are overlapped by the abaxial-laterals. The calyx scales are broad, shield-like and fan-like, with entire margins around the overlapping portion; the overlapped portion contains the nucleus, surrounded by numerous finely-tuberculate warts. The clear border between the outer margin and the warted portion bears radiating ridges. The following measurements were taken of the length and breadth of

the calyx scales in millimetres:—·544 x ·442; ·408 x ·595; ·289 x ·425; ·272 x ·306; ·204 x ·374; ·357 x ·374. The eight opercular scales are of equal size—·425 x ·238 mm.; ·391 x ·204 mm. They are high, sharply-pointed isosceles triangles, bearing a strong median ridge; another ridge runs at right angles to the median ridge across the basal portion, so that the two together form a sort of T-square. Numerous small warts and jagged projections are grouped along the sides of the main ridges, and occur more sparsely over the "blade" of the scale; the margins of the two long sides of the scale are entire. The spicules of the cœnenchyma are for the most part scales, thicker than those of the calyces, and without the clear border; they show a diversity of form, oval, fan-shaped, triangular, etc., and are closely covered with tuberculate warts which surround an excentric nucleus; their dimensions are:—·374 x ·391 mm.; ·323 x ·153 mm.; ·272 x ·204 mm.; ·204 x ·17 mm. There are also a few small approximately spherical bodies, covered with warts, ·068 x ·068 mm.; ·085 x ·085 mm.; ·102 x ·102 mm.

The colour of the colonies is light brown with polyps of a lighter shade. The axis is dark brown to greenish-bronze, and is finely grooved.

This species agrees in many respects with *Plumarella spinosa*, Kükenthal. *P. spinosa*, however, has the opercular scales of very unequal size, and the scales have throughout a rather different type of ornamentation from that in our specimens.

Locality.—Eleven miles E. by N. of Broken Bay, 30-40 fathoms.

PLUMARELLA CORRUSCANS, *sp. nov.*

(Plate lxv., fig. 4; pl. lxviii., fig. 8; pl. lxxvii.)

Stations 40, 44, 47.

This is an extremely beautiful and graceful form with typically feather-like branching. It is well represented both among the dried specimens and among those in spirit. The largest specimen is an almost perfect colony, about 44 cm. high, with a maximum breadth across the branched portion of 26 cm. A well-developed calcareous expansion, about 2 mm. thick, attaches the colony to the substratum. From this there rises a cylindrical stem, 6 mm. in diameter, which almost from its origin gives off twigs in a single row along each side. At a height of about 19 cm. the stem divides into two main branches, which in their turn give off lesser

branches. All these ramifications bear numerous twigs which alternate in a single row along each side. There are about thirteen twigs in each row in a length of 5 cm.; the average length of a twig is 4 cm.

The polyps occur in a single row on each side of the twigs and branches—those of one row alternating with those of the other. There is great evenness and regularity in their arrangement; they never encroach on the middle line. There are about ten polyps to 1 cm. in each row; the tip of one polyp just reaches to the base of the one immediately above, the length of a polyp being 1 mm. Among the normal-sized polyps in some of the specimens there are here and there large swollen polyps of about twice the size of the others. These contain reproductive bodies.

Seen with a lens, the entire surface of the colony, both cœnenchyma and polyps, presents a glistening frosted appearance that is very characteristic. The axis is almost black, and bears fine longitudinal striations.

The polyps are armed with well-defined longitudinal rows of broad, overlapping scales; there are about six of these in the abaxials, but in the lateral rows the number is considerably reduced, and the adaxials are indistinct. The operculum of eight isosceles triangles is rather high and conical in the normal-sized polyps, but much lower and flatter in the large individuals. The armature of the two kinds of polyps does not otherwise differ in any marked way, except that the scales on the bodies of the large polyps are much larger than those on the small polyps.

The polyp scales are rather thin, fan-shaped "ctenoid" forms, with a well-marked nucleus surrounded by tuberculate warts, and a relatively broad clear border round the upper half of the scale, bearing a few strongly-marked radiating ridges. The following measurements were taken of length and breadth in millimetres:—·255 x ·204; ·204 x ·238; ·17 x ·136.

The opercular scales are, as usual, isosceles triangles with a median ridge, bearing numerous small warts without definite arrangement. These scales are throughout of very uniform size —·459 x ·221 mm. The scales of the coenenchyma are irregularly circular or oval; they are smaller than those of the polyps (·107 x ·136 mm.; ·102 x ·102 mm.), and have a number of warts surrounding an approximately central nucleus.

The colour of the colonies is usually light brown; one dried specimen has a pinkish colour, which is apparently soluble, for a piece put in alcohol stained the liquid pink after a short time.

Locality.—Coast between Port Jackson and Port Hacking.

PLUMARELLA FILICOIDES, *sp.nov.*

(Plate lxv., fig. 5 ; pl. lxviii., fig. 1 ; pl. lxxviii.)

Stations 13, 17, 34, 48.

Several colonies, each a single fern-like frond, the largest 23 cm. in height. From a slightly encrusting base rises the cylindrical stem—3·5 mm. in diameter—which, from a point about 2 cm. above the base bears a single row of twigs along each side, the twigs on one side alternating with those on the other. The average length of these twigs is 4 cm. and their diameter 2 mm. They are rather distant, there being about twelve on each side in a stretch of 5 cm. In a few cases a stouter branch is given off from near the summit of the colony, bearing in its turn lesser twigs in a single row on each side.

The whole surface of the twigs is covered with a close-wound spiral of polyps ; on the stem the polyp-arrangement is bilateral, though here and there a few encroach on the middle line.

The polyps show distinct dimorphism. The majority are very small (·5 mm. long), and inconspicuous, being partially sunk in the cœnenchyma, and pressed against the branch. They are armoured with a few broad scales ; in the abaxials, which are the most complete of the longitudinal rows, there are from three to four scales ; the adaxials are practically absent. The operculum is a sharp cone, formed of eight rather high isosceles triangles.

Here and there among the smaller polyps there are large polyps of about twice the size. These are pressed against the branch, but are so swollen out with reproductive bodies that they project as large, rounded warts. Not only in size do these larger polyps differ from the others ; they have a much lower operculum, and their armature consists of a larger number of scales—there are usually four scales in the abaxial rows and two to three in the adaxial-laterals. The polyp-scales are broad and heavy, approximately fan-shaped, and closely studded with tuberculate warts ; the clear border of the scale is very narrow, and bears well-marked ridges. The following measurements were taken of length and breadth in millimetres :—·476 x ·357 ; ·391 x ·204 ; ·391 x ·51 ; ·289 x ·272. The opercular scales have dimensions of ·391 x ·204 mm.; ·323 x ·204 mm. They are marked with a strong T-square ridge ; the clear border is relatively broad and smooth.

The cœnenchyma is covered with a close mail of rather large scales, similar to those on the polyps, but with the clear border either very narrow or entirely obsolete. The following measure-

ments were taken :—·323 x ·357 mm.; ·272 x ·255 mm.; ·119 x ·085 mm. The colour of the majority of the colonies is red-brown; one small specimen is cream-coloured, with very opaque spicules. The axis is greenish-bronze, with fine longitudinal striations.

Locality.—South Coast, New South Wales.

PLUMARELLA VERSLUYSI, *sp. nov.*

(Plate lxvi., fig. 4; pl. lxviii., fig. 2; pl. lxxix.)

Station 53.

The largest specimen has a height of 22·5 cm. with a width of about 12 cm. across the branched portion; the basal attachment is lacking. The branching is confined to one plane, and is typically feather-like. Along each side of the stem and main branches there is a row of twigs alternating with those of the opposite side. The average length of a twig is 2 cm. with a diameter of 2 mm.; there are about fourteen twigs on each side of a branch in a length of 5 cm. The polyps are arranged bilaterally on the larger branches; on the twigs their arrangement is also lateral, but a few may encroach on the middle line. Usually they stand in a single row, but occasionally the row is doubled.

The polyps are of two sizes; the majority are very small, ·75 mm. in length; here and there occur larger, more swollen polyps, 1·25 mm. in length. In the smaller polyps the armature consists of overlapping scales, of which there are about four in the abaxial longitudinal rows; the lateral rows are very indistinct, and the adaxials practically obsolete; the uppermost of each longitudinal row is larger than the rest and projects, so that a slight circumoperculum is formed. The operculum is well-defined and conical, formed of eight approximately equal isosceles triangles. The armature of the larger polyps is of the same general type as that just described; but the longitudinal rows are even less distinct, the polyp scales are rather larger and more numerous, and the operculum is low.

The polyp-scales are broad and fan-shaped, with a distinct nucleus, numerous tuberculate warts, and a clear fluted margin round the part of the scale that projects when on the polyp. The general appearance of the scales is very similar to those of *Plumarella filicoides*, but they are markedly thinner, and less heavily sculptured than in that species. The following measurements were taken of length and breadth in millimetres:—·425 x ·289; ·306 x ·306; ·255 x ·187. The opercular scales are similar to those of *P. filicoides*, but are less strongly ridged—·34 x ·204 mm.; ·289 x ·187 mm.

The colour of the colony is rufous-brown, the polyps rather lighter.

Position.—This species approaches very closely *Plumarella filicoides*. The chief points of difference from that species are—(1) its more slender build, and greater tendency to branch; (2) the bilateral arrangement of the polyps; (3) the rather larger size of the polyps; (4) the larger number of scales in the abaxial rows on the polyps; and (5) the less heavy type of spicules.

Genus PRIMNOELLA, *Gray*.

PRIMNOELLA AUSTRALASIÆ, *Gray*.

(Plate lxi., fig. 1.)

Primnoella australasiæ, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, p. 88, pl. xviii., figs. 1, 1a, pl. xxi., fig. 15.

Primnoella australasiæ, Versluys, Gorgoniden der Siboga Expedition, ii. Die Primnoidæ, 1906, pp. 52-54, figs. 55-59.

Stations 31, 41, 42, 43, 44, 47, 48, 53, 54.

The three largest specimens are 135 cm., 113 cm., and 83 cm. in length. In very few cases is the cœnenchyma intact; generally it is more or less worn away, and the axis of the colony is overgrown with Palythoids, Cirripedes, and in one case by *Alcyonium* (*Erythropodium*) *reptans*, Kükenthal.

Localities.—Eleven miles east of Broken Bay; Cape Hawke, 25-28 fathoms.

Previously recorded from Australian Seas; New Zealand; Bluff Harbour, Tasmania, 7 fathoms; Port Jackson (New South Wales), 150 fathoms; Station 163A, off Twofold Bay (New South Wales), 150 fathoms.

PRIMNOELLA FLAGELLUM, *Studer*.

Primnoella flagellum, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, p. 85, pl. xviii., figs. 2, 2a, pl. xxi., fig. 12.

Station 48.

A single specimen, 155 cm. in length, without a basal attachment. The lower part of the wire-like axis is worn bare of cœnenchyma; above this, 20 cms. of the length is encrusted with Cirripedes and *Alcyonium* (*Erythropodium*) *reptans*, Kükenthal. The remainder of the colony is a long, flexible, whip-like, unbranched stem, closely covered with polyps arranged in whorls, and having an almost uniform diameter of 2 mm. There are about eight polyps in a whorl; the average length of a polyp is 1·5 mm. The geographical distribution is remarkable.

Previously recorded from—Station 308, off Tom Bay, Patagonia, 175 fathoms; S. Atlantic, near S. American coast, Lat. 43° 56′ 2″ S., Long. 60° 25′ 2″ W., 60 fathoms.

PRIMNOELLA DISTANS, *Studer*.

Primnoella distans, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 85, 86, pl. xvii., figs. 1, 1a.

Stations 34, 42.

There are a number of broken pieces of this delicate form, some with the peculiar stolon-like basal attachments. The largest specimen is 15·5 cm. long. The polyps are for the most part in opposite pairs, but whorls of three occur. There are usually only five transverse rows of scales in the abaxial rows on the polyp-calyx—never so many as seven to eight, as described by Wright and Studer.

Previously recorded from—Station 23, off Sombrero, West Indies, 450 fathoms; Station 122 A-C, off Pernambuco, 120-400 fathoms; Lat. 22°21′ S., Long. 154° 7′ 7″ E., 550 fathoms.

Genus CALIGORGIA, *Gray* (emend. *Studer*).

CALIGORGIA LAEVIS, *sp. nov.*

(Plate lxv., fig. 1; pl. lxviii., fig. 7; pl. lxxx.)

Stations 47, 48.

Several incomplete branching specimens, the largest with a height of 20 cm. In two cases the stem is partially overgrown by a sponge. Branching is luxuriant and typically dichotomous; the angle of the dichotomy is small. The diameter of the thickest branches is 2·5 mm. The axis is brown.

The polyps are arranged in close whorls on the thicker branches as well as on the slender twigs. The average number of polyps in a whorl is four, but six sometimes occur, especially where a dichotomy is about to be formed, and eight is a common number on the thicker branches. The usual number of whorls in a length of 3 cm. is twenty-two to twenty-four; the length of a polyp is about 1 mm. The mouths are directed distally.

The only complete longitudinal rows of calyx scales are the abaxial and the abaxial-lateral; there are never more than nine overlapping scales in the abaxial rows; the number in the abaxial lateral is more variable, but is usually about six. The adaxial and adaxial-lateral rows are very incomplete, usually consisting of two to three scales. The opercular scales are triangular and pointed, the two abaxials being slightly larger than the others.

The calyx scales are mostly rounded or oval "ctenoid" forms, with a distinct nucleus round which are grouped numerous warts. The outline is usually entire for about two-thirds of the circumference, and the clear space between the central warted portion and the edge is quite smooth, without any hint of ridges or flutings. The following measurements were taken of length and breadth in millimetres—·272 x ·238 ; ·254 x ·153 ; ·221 x ·221 ; ·119 x ·102. The opercular scales are isosceles triangles (·34 x ·17 mm.) ; the margin is entire for the greater part of the two longer sides, and all the upper portion of the scale is smooth ; the nucleus is situated near the base of the triangle, and is surrounded by numerous warts. The spicules of the cœnenchyma are small scales and irregular bodies—·102 x ·085; ·085 x ·051; ·068 x ·068; ·051 x ·034 mm.

The colour of the colonies is pale brown to cream.

This species agrees in many ways with the description of *Caligorgia elegans* (Gray), given by Kinoshita,[9] but is distinguished from that species by the entire margins and smooth borders of the scales, and the smaller number of scales in the abaxial rows of the polyp calyx. It may also be noted that our specimens never have as many as eighteen polyps to a whorl, nor are the polyps ever arranged irregularly on the stouter branches, as in *Caligorgia elegans* (Gray).

Family GORGONIDÆ.

Genus LEPTOGORGIA, *Milne-Edwards* (emend. *Verrill*).

LEPTOGORGIA, *sp.*?

A single specimen is referable to the genus *Leptogorgia*, but it is small and incomplete, and we do not feel justified in saying more than that it is in the neighbourhood of *Leptogorgia alba*, Verrill, and *Leptogorgia flexilis*, Verrill.

The height of the colony is 9 cm., with an almost constant diameter of 2 mm. Four simple branches are given off along one side of the stem at intervals varying from 3·5 to 8 mm. Both stem and branches are somewhat flattened. The polyps are arranged laterally ; their openings are very small and inconspicuous; and they are completely retracted into the cœnenchyma.

The spicules are colourless, double spindles—·132 x ·035 mm.; ·091 x ·046 mm.; ·036 x ·03 mm.; and a few crosses, ·068 x ·045 mm.

The colour of the colony is pale fawn.

Locality.—Between Port Jackson and Tuggerah, N. S. Wales.

[9] Kinoshita—Primnoidæ of Japan, Journ. College Sci. Tokyo, xxiii., 1908.

Family GORGONELLIDÆ.

Genus CTENOCELLA[10], *Valenciennes.*

CTENOCELLA PECTINATA, *Pallas.*

(Plate lxxxi.)

Ctenocella pectinata, Pallas, Elenchus Zoophytorum, 1766, p. 179.

Ctenocella pectinata, Ridley, Zool. Coll. H.M.S. "Alert," 1884, p. 348.

Ctenocella pectinata, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, p lxvi.

Stations 34, 42, 44, 47.

There are several very perfect colonies of typical lyre-shape; they are all in the dried condition. The height of the largest specimen is 50 cm., with a width of 42 cm. From a slightly encrusting base rises a cylindrical stem, 7 mm. in diameter, which soon forks. The two branches thus formed diverge at an angle of 45°, and give off, along the upper side only, a series of parallel, ascending twigs. The space between two twigs is about 8 mm. One or two of these lesser branches may be stronger than the rest, and may give off numerous ascending twigs in turn, or fork dichotomously. More generally, the branches are simple, from 4-12 cm. in length, and with an almost uniform diameter of 2-3 mm.

The axis is light brown, and strongly furrowed. The cœnenchyma is thin, but very compact and smooth; in many places a distinct median furrow can be made out.

The polyps have, on the twigs, an irregular bilateral arrangement, but on the larger branches they occur all over the surface. They are very numerous, about 0·5 mm. apart, and are all retracted into very low, wart-like verrucæ.

The spicules include the following types:—colourless double clubs—·068 x ·034 mm.; ·051 x ·034 mm.; a few crosses—.051 x ·051 mm.; ·034 x 0·34 mm.; and more elongated forms approaching double-spindles, with scarcely any "waist"—·085 x ·025 mm.; ·068 x 0·25 mm.

The colour of the specimens is cream-white to yellowish.

Locality.—Eleven miles east of Broken Bay.

Previously recorded from Indian Ocean, seas of the Moluccas, India and China, Cuba, Australia (Warrior Reefs, Torres Strait, 12 fathoms; off N. W. Cape, W. Australia, 3-4 fathoms).

[10] In his "Revision of the Gorgonellidæ" (Proc. Roy. Irish Academy, 1910, p. 319), Mr. J. J. Simpson has shown convincingly that the genus *Ctenocella* should be merged in *Scirpearia*.

Order V. STELECHOTOKEA, *Bourne.*

Family TELESTIDÆ.

Genus TELESTO, *Lamouroux.*

TELESTO TRICHOSTEMMA, *Dana.*

Telesto trichostemma, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 264, 265.

Station 44.

Three branching specimens, much overgrown with Hydroids, etc. The largest specimen is 19·5 cm. in height, with an average diameter of 2·5 mm. The polyps are about 5 mm. apart; they are 2·5-3 mm. in height, and project at an angle of 45° to 60°. The spicules are as described by Wright and Studer, *i.e.*, "elongated spindles with strong lateral spines, often provided with lateral branched processes, or forked at one extremity." The colour of the specimens is yellowish-brown.

Previously recorded from Torres Strait, 3-11 fathoms; Fiji Islands; Maldives.

TELESTO ARBOREA, *Wright and Studer.*

(Plate lxvii., fig. 2.)

Telesto arborea, Wright and Studer, Chall. Rep., Zool., xxxi., 1889, pp. 262-264, pl. xxxix., figs. 1, 1a.

Telesto arborea, Thomson and Henderson, Proc. Zool. Soc., 1906, pp. 434-435.

Station 42.

There are a few small, much broken species in the present collection. The lateral polyps have dimensions of 4 x 2 mm. or 5 x 2·5 mm. The colour is dark brown. The spicules are as described by Wright and Studer; we give a figure of them here, as there is apparently none in any previous report of this species.

Previously recorded from Arafura Sea, 49 fathoms; Zanzibar (Kokotoni Harbour, 5 fathoms, and Wasin Channel, 10 fathoms); Maldives.

Family KOPHOBELEMNONIDÆ.

Genus KOPHOBELEMNON, *Kölliker.*

KOPHOBELEMNON SCHMELTZII (*Kölliker*).

Sclerobelemnon schmeltzii, Kölliker, Anatom. Systemat. Beschreib. Alcyonarien, 1 Abth. Die Pennatuliden, 1872, p. 312, pl. xxi., figs. 184A, 184B, 185.

Station 25.

Three specimens of a chocolate-brown *Kophobelemnon*. The colonies are cylindrical, 13-14 cm. high, the polyp-bearing portion rather thicker (7-9 mm.) than the stalk (5-6 mm.); there is no terminal bladder; the polyps are arranged in rather irregular longitudinal rows, leaving only a small bare strip on the prorachidial side. The tentacles of the polyps are without spicules. The upper part of the polyps is much poorer in spicules than the lower. Siphonozooids, small, brown, wart-like, in very numerous longitudinal rows. Axis thick, with a tendency to quadrangular cross-section in the lower part of the colony. Spicules biscuit-shaped, flat discs and ∞-shapes, with a few warts. They are very sparse in the cutis of the stalk, numerous in the club portion round the siphonozooids and on the polyps, absent in the interior.

This description agrees with that of *Sclerobelemnon schmeltzii*, Kölliker.

Thomson and Simpson have shown[11] that it is impossible to maintain a hard and fast line between the genera *Kophobelemnon* and *Sclerobelemon*, since there exist species such as *Kophobelemnon bürgeri*, Herklots, and *K. intermedium*, Thomson and Simpson, partaking of the characters of both. We therefore keep this species in the older genus *Kophobelemnon*.

Locality.—Off Newcastle, 24-48 fathoms.

Previously recorded from Formosa.

Family PTEROEIDIDÆ.

Genus GODEFFROYIA, *Kölliker.*

GODEFFROYIA ELEGANS, *Kölliker.*

Godeffroyia elegans, Kölliker, Anatom. Systemat. Beschreib. Alcyonarien, 1 Abth. Die Pennatuliden, 1872, p. 116, figs. 63-65.

Stations 22, 54.

Kölliker gives the following statement of the generic characters —"Small, delicate sea-pens, of the same type of growth as *Pter-*

[11] Thomson and Simpson—An account of the Alcyonarians collected by R.I.M.S.S. "Investigator" in the Indian Ocean. Part ii, 1909.

oeides. The siphonozooid-plate forms on the ventral border of the pinnule a cushion that extends on to the keel. Pinnules provided with *one* strong supporting row of needle-like spicules on the ventral border only, otherwise without strong rays of spicules. Autozooid zone abutting on the ventral spicule row, supported by numerous small needles, and having several rows of autozooids on each side."

This diagnosis was founded on a single specimen of small dimensions. Our three specimens agree with it in all essentials, but are very much larger.

The following table gives their dimensions in centimetres :—

	Sp. A.	Sp. B.	Sp. C.
Length of entire colony	19	18	14
,, rachis	10	9·5	8·5
,, stalk	9	8·5	5·5
Breadth of rachis	5·5	5	4·5
,, stalk	1·4	1·2	1·1
,, keel in the middle ...	1·5	0·8	0·9
Length of pinnules on ventral side...	3	2·5	2
Maximum breadth of pinnules ...	1·1	0·9	0·8
Number of pinnules on each side ...	35	27	26

The colour of all three specimens is dark brown, with a purplish tinge on the keel and pinnules.

Previously recorded from the Gulf of Siam.

Genus SARCOPHYLLUM, *Kölliker*.

SARCOPHYLLUM AUSTRALE, *Kölliker*.

(Plate lxxxii.)

Sarcophyllum australe, Kölliker, Anatom. Systemat. Beschreib. Alcyonarien, 1 Abth. Die Pennatuliden, 1872, p. 116, figs. 66, 67.

Stations 28, 31, 32, 54.

A number of specimens agree in the main with Kölliker's account of *Sarcophyllum australe*. At the intersections of the pinnules there are, on the ventral side, prominent transverse cushions bearing minute siphonozooids. The spicules in the interior of the lower part of the stem are relatively enormous, white 8-shaped forms and a few discs, at once visible to the naked eye. With regard to the other characters, we found some variation in the different specimens, variations that may well be dependent on the age and vigour of the colony. For instance, in the larger specimens there are numerous rows of autozooids on the pinnules, in accordance with Kölliker's account, but a small and obviously young specimen has on most pinnules only one row

of autozooids, rarely two. Hickson notes much the same thing in his Preliminary Report on a collection of Alcyonaria and Zoantharia from Port Phillip.[12]

Again, one of the marks that is given by Kölliker to distinguish the genus *Sarcophyllum* from *Pteroeides* is the absence of spicule-rays in the pinnules. We found this to hold true for all the larger specimens, but, in the young colony above referred to, which has much less fleshy pinnules, the rays of spicules were very well marked. This seems to us of considerable interest as indicating the danger that arises from basing genera on characters that may be present in the full-grown form only. We were in considerable difficulty in the present instance, until we detected the eminently characteristic spicules of *Sarcophyllum australe* in the base of the colony. The following table gives the dimensions in cm. of the largest, and of the smallest specimens :—

	Specimen A.	Specimen B.
Length of the entire colony ...	22·5	7·2
,, rachis	13	3·5
,, stalk...	9·5	3·7
Breadth of the rachis	6·5	0·9
,, stalk	5·5	0·3
Maximum breadth of pinnules ...	3	0·4
Height of pinnules in the middle ...	2	0·4
Number of pinnules on each side ...	30	27

In all the larger colonies the stalk is greatly swollen midway between the rachis and the base. The smallest specimen shows no such swelling.

The colour of the specimen is light brown to dark chocolate-brown, sometimes with a purplish tinge here and there.

Localities.—Cape Hawke, 10-12 fathoms, and 25-28 fathoms ; off Port Stephen, 32-48 fathoms.

Previously recorded from Australia—Port Phillip, Victoria (Hickson).

[12]Hickson—Proc. Roy. Soc. Vict., n.s., ii., 1890, p. 136.

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AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 14.

ECHINODERMATA.

(SUPPLEMENT.)

Published 27th January, 1911.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator

SYDNEY, 1911.

F. Cunninghame & Co. Limited, Printers, 146 Pitt Street, Sydney.

SUPPLEMENT TO

ECHINODERMATA.

By HEDLEY L. COLEMAN.
Cadet.

SUPPLEMENT TO

ECHINODERMATA.

By Hedley L. Coleman.

(Plate lxxxiii., and figs. 123-125.)

In the Report on the "Thetis" Echinoderms[1] Prof. H. L. Clark referred two specimens of a fine large Asteroid to *Nectria ocellifera*, Lamk. Subsequent to the publication of his paper, he found that a mistake had been made. He therefore wrote to the Curator of this Museum pointing out that the specimens in question really constituted a new species of the genus *Asterodiscus*, Gray. ; at the same time suggesting that I should describe it. For this compliment I wish to tender my grateful acknowledgment.

ASTERODISCUS TRUNCATUS, sp. nov.

(Plate lxxxiii. and figs. 123-125.)

Nectria ocellifera, H. L. Clark, Mem. Austr. Mus., iv., 1909, p. 529 (non Lamk.)

Rays 5. R=103 mm. ; r=51 mm. R=2r. Breadth of ray at base 50 mm. Disc large and inflated. Rays broad, fairly long, tapering to a blunt extremity ; slightly unequal as to length and breadth. Interbrachial arcs widely rounded. Side of body fairly high, well rounded. Abactinal surface covered with numerous tubercles, having the form of inverted, truncated cones, which are slightly convex at the surface (fig. 123). A median radial line, and an adradial series distinguishable, beyond these the tubercles irregular. Each tubercle stands on a prominence of the test, and the larger ones are confined to the disc and bases of the rays. Scattered among the tubercles are large spherical granules, which vary slightly in size. Marginal plates not conspicuous. Corresponding to supermarginals are three ossicles (from interradial line) omitting large plate at extremity of ray.

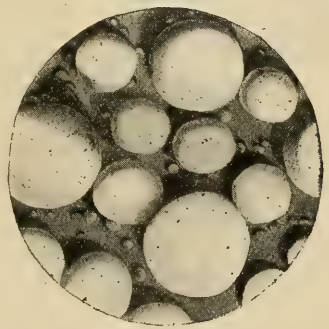

Fig. 123.

[1] Austr. Mus. Mem. iv., 1909, p. 529.

The innermost ossicle is near the interradial line, about 5 mm. from its fellow of the adjacent ray. Second ossicle 12·20 mm. from the first, and about same distance from the third. The third ossicle about 30 mm. from the large plate at tip. Each ossicle is circular, and convex, the first and second about 4 mm. in diameter, the third about 3 mm. Each is encircled by a row of bead-like granules. Large plate at end of ray nearly circular (8 mm. across) tumid, and encircled by a ring of small oblong granules. Infermarginal plates 9 to 10; separated (at base of ray) from supermarginals by about 8 mm. of test, covered with tubercles, and granules. The five innermost ossicles generally bear a large tubercle on their upper edge, while the eighth to the tenth bear on the lower surface a conical ossicle. Each inferomarginal ossicle is encircled by a row of small, irregular granules. The last three plates are wedged in between the large terminal supermarginal and adambulacral plates. Actinal area paved with fairly regular rows of rounded, acorn-shaped tubercles. Each tubercle surrounded by a row of large, irregular granules. Adambulacral armature composed of: (1) a furrow series of four (towards extremity of ray three) subcylindrical, blunt-pointed, spines, subequal except the adoral, which is smaller. (2) On the actinal surface of the plate a transverse series of two (towards extremity of ray one) stout, four-sided spines. The outer spine smaller, and often three-sided. On inner side of each armature are three or four irregular granules (fig. 124). Mouth plates with a furrow series of seven or eight spines, similar to those of the adambulacrals, except the inner one, which is stouter. A row of four large, blunt spines on the actinal surface, parallel with the furrow series, the adoral one smaller. Pincer-shaped pedicellariæ (fig. 125) occur on both series of marginal plates, and are plentiful on the actinal interradial areas. One is rarely found on the adoral side of an adambulacral plate, between the two spines. They are also not uncommon on the dorsal surface. Madreporite conspicuous, situated about one-third distance from centre to the margin, on the interradial line. Striations convoluted. Anus subcentral, surrounded by seven large, pear-shaped granules. Colour in alcohol, light chocolate.

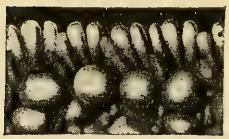

Fig. 124.

Fig. 125.

Obs. A larger specimen (R=130 mm.), collected by the Fisheries Investigation Vessel "Endeavor," has the larger tubercles of the dorsal surface flat-topped. Also six of the super-

marginal plates bear a small tubercle on the lower side. This is the specimen figured.

This species may be distinguished from *A. tuberculosus*, Fisher[2], by the form of the dorsal tubercles, which are broad at the distal extremity and but slightly convex, while in Fisher's species they are pointed. The spines of the adambulacral armature are in series of 4, 1, and 1., as compared with 6, 2, and 1, in *A. tuberculosus*. It also differs in several important features from *A. elegans*, Gray[3]. The rays are much longer in proportion to the size of the disc, and the tubercles of under surface are not larger and more crowded towards the mouth. The spines of the adambulacral armature are in series of 4, 1, and 1., as compared with 5, 2, and 1., in Gray's species.

Localities.—Off Botany Bay, 79-80 fms.; sand and stones ("Thetis"). South Australia, 15 miles south of St. Francis Is., 30 fms.; Off East Coast of Victoria ("Endeavor").

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[2]Fisher—Bull. U.S. Fish. Comm., xxiii., pt. iii., 1903, p. 1075.

[3]Gray—Proc. Zool. Soc., xv., 1847, p. 75.

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AUSTRALIAN MUSEUM, SYDNEY.

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OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 15.

RECENT CRINOIDS OF AUSTRALIA.

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The Editor does not hold himself responsible for the error in pagination exhibited on pp. 706-750. This occurred through circumstances wholly without his control.

THE RECENT CRINOIDS OF AUSTRALIA.

By Austin Hobart Clark,
U.S. National Museum, Washington.

THE RECENT CRINOIDS OF AUSTRALIA.

By Austin Hobart Clark.

Introduction.

The Trustees of the Australian Museum have done me the honour of entrusting to me for study their entire collection of Australian Crinoids.

The Crinoid fauna of the Australian coasts is of the greatest interest, not alone from the abundance and variety of its component species, but from its similarity in certain ways to that of the Jurassic and later horizons of Europe. Previous to the receipt of this collection I had only been able to examine occasional specimens, representing, however, numerous species, from Australia, mostly from Sydney, together with the collection made by the German ship "Gazelle" at various points on the west and north-west coasts. It was therefore with the greatest anticipation that I undertook the study of the collections of the Australian Museum, a study which has assisted in elucidating a number of hitherto obscure points and in giving me a much clearer idea of the Crinoid fauna of Australia as a whole.

I wish to record my appreciation of the kindness shown me by the Trustees of the Australian Museum and by the Curator, Mr. R. Etheridge, Junr., and to thank these gentlemen for the privilege I have enjoyed in being permitted to examine their very extensive and valuable collections.

At the time this collection was received I had at hand the Crinoids belonging to the University of Copenhagen, those of the Berlin Museum, including several of Professor Johannes Müller's types, those of the Indian Museum, the specimens collected by the German steamer "Gazelle," and by the Indian steamers "Investigator" and "Golden Crown." In addition the enormous collections of the United States National Museum were under my care, as well as the large mass of material brought together by the United States Fisheries steamer "Albatross," when working among the Philippine Islands. Altogether the available material comprised some dozens of Australian specimens, and some hundreds of specimens of species occurring in Australia, so that I had ample facilities for making comparisons between the individuals in the Australian Museum collection and valuable material belonging to other institutions.

I happened to be in Cambridge, Massachusetts, at the time that my friend, Dr. Hubert Lyman Clark, was studying the

Echinoderms collected by the "Thetis" and, with his usual kindness, he permitted me to take one from the Crinoids which were among them, and I shall take the opportunity of including it in the present paper.

While this paper was in press I visited all the Museums of Europe which I had reason to think contained Australian Crinoids. In London, thanks to the courtesy of Professor F. Jeffrey Bell, I was permitted to examine the collections upon which his list of the Crinoids of North-western Australia was based, the historic "Alert" collections, and a considerable amount of unrecorded material. At Paris, thanks to the kindness of MM. E. Perrier and L. Joubin, I was enabled to examine the Australian specimens—all in a wonderfully perfect state of preservation—described nearly one hundred years ago by Lamarck, as well as those described at a later date by Johannes Müller. Drs. F. A. Jentink and R. Horst, at Leyden, most generously allowed me to study the historic specimens under their care, while Professors K. Kraepelin and G. Pfeffer extended similar courtesies to me at Hamburg.

Upon my return to the United States, Professor W. Michaelsen, of Hamburg, sent to me the Crinoids which he, together with Dr. R. Hartmeyer, of Berlin, had collected on the west coast of Australia. Though a large collection, it does not alter the generalizations herein expressed to any appreciable degree.

Thus in the preparation of this Report I have personally examined the type specimen of every species of Crinoid recorded from Australia, and also practically every specimen which, so far as can be ascertained, has ever been sent abroad from that country.

In certain cases the examination of the types has shown that the present conception of the species is entirely erroneous, and it has frequently happened that species have been recorded under incorrect names. The rectification of these errors has necessitated a somewhat extensive revision of the proof, and for the trouble caused thereby I offer to the Editor of these Memoirs a sincere apology.

Among the Crinoids sent to me were a few from the Solomon Islands, taken mostly at Ugi. I have thought it best to consider these apart from those from the Australian coasts, as the faunal relations of the Solomons are somewhat different from those of Australia. These are therefore treated in a paper which will appear in a forthcoming number of the Museum "Records," and, though short, represents the sum of our knowledge regarding the Crinoid fauna of those Islands, and is accompanied by a bibliography which includes all the papers I have been able to find where Solomon Island Crinoids are mentioned.

A few other specimens are from scattered localities; but some of these are of very exceptional interest, and cannot justly be omitted from consideration. They are therefore included with the above.

From a palæontological point of view the study of the recent Crinoids is of more importance than that of any other animals so far as the marine deposits are concerned. There are three reasons for this :—

(1). The Crinoids are animals of the greatest antiquity and their palæontological record therefore shows a succession of forms none of which depart very widely from the general type; developmentally speaking the lapse of time since the first vestiges of crinoidal remains is infinitesimal, and the Crinoids of the several past horizons can only logically be considered as constituting so many separate zoögeographic areas, all of equal value, and all equal in terms of phylogenetic development to the zoögeographic areas of to-day. In fact one is almost justified in stating that the phylogenetic perfection of the Crinoids is in inverse proportion to their age as we know it from their position in the rocks, so great has been their specialization in the past, and a phylogenetic tree beginning with the Crinoids of the present day and ending with those of the Cambrian would have just as much to recommend it as one following the so-called development of the class from Cambrian times to the recent epoch. Thus, the past history of the Crinoids may be said to be a radial, instead of a linear, succession of types, each one of which takes a position on or near the circumference of a circle, and all of which are nearly equidistant from the two or three indicated primitive types which occupy its centre.

(2). The Crinoids are securely attached by a stem and root, and thus immovably fixed, or attach themselves to various objects by means of their cirri, remaining as a rule stationary for life; the young are always fixed. As we know it, the free larval existence is passed chiefly within the vitelline membrane attached to the pinnules of the parent, the actual free swimming stage not being of more than forty-eight hours' duration. Thus, of all marine animals the Crinoids are the most nearly strictly sessile. This renders them most valuable aids in tracing out the fundamental facts of the distribution of marine animals, both past and present, for it reduces to a minimum the effect of ocean currents upon them, and, since individual species are strictly limited in their thermal and bathymetric range (especially in the former), it results in the interposition of certain barriers to their distribution more or less inoperative in the case of other animals, including the other Echinoderms. Chief among these barriers are deep channels of considerable width which the littoral and

sublittoral species cannot cross as their larvæ develop the normal impulse for fixation in a shorter time than that required to drift to the other side, and thus fall into deep water amidst a cold and unnatural environment, and perish. Rivers of considerable volume and depth act in exactly the same way; the larvæ, on account of their short duration of existence *as* larvæ, cannot pass around the fatal fresh water, nor, if the river be very deep, can they pass beneath it.

(3). The Crinoids are the most highly calcified of organisms, and the most uniformly calcified as a class, exhibiting, so far as we know, but very slight variation. The smallest Comatulids, with arms scarcely half an inch long, probably never have less than 20,000 distinct skeletal elements, while it has been estimated that the large Pentacrinites possess 5,000,000; personally I think the latter estimate slightly too conservative as it takes no account of the visceral skeleton. Thus, the Crinoids are peculiarly susceptible of preservation, and hence their excellent palæontological record, surpassing even that of the molluscs.

As subjects for study in all lines the Crinoids offer wonderful possibilities, and in no place can their study be prosecuted to such advantage as in Australia where the multitude of forms easily available occur largely within easy reach of important scientific centres. It is mainly to Australia, therefore, that the world must look for the solution of the problems dealing with these animals, and the Australian naturalists will be the ones to whom the naturalists of other lands must look for guidance.

Only a very feeble beginning has been made in the study of the recent Crinoids, even from a systematic standpoint. The proportion of known to unknown forms is still very small, as is graphically brought out by the study of any large collection, and remarkable new genera are being brought to light with increasing frequency.

The anatomy of two species of *Antedon*, *A. bifida* and *A. mediterranea*, has been studied by Ludwig, Perrier, Hamann, and the two Carpenters, who also discussed in more or less detail that of *Heliometra glacialis* and a few other species such as *Comanthus parvicirra*, *Neocomatella alata*, and *Comatella nigra*; but the refinement of technique and especially of methods of fixation since their work was done—work which was almost wholly based upon more or less poorly preserved alcoholic material—have made the field one of very great promise, entirely untouched so far as Australian species are concerned.

Dendy's studies on the regeneration of the disk, and Minckert's, Perrier's, and Przibram's on the regeneration of the disk and arms have indicated most interesting lines of work, and pointed

out some very remarkable facts, but can scarcely be said to have done more; Reichensperger's investigation of the glands and their secretions have opened up interesting questions of physiology.

The work of Wyville Thomson, W. B. Carpenter, Perrier, and especially of Barrois, Bury, and Seeliger has laid a foundation, though one with many weak spots, upon which to build up the study of the comparative embryology of the Crinoids; but no one up to this time has attempted any embryological investigation outside of the genus *Antedon*, Thomson, Carpenter, and Perrier treating of *Antedon bifida*, Barrois and Bury of *A. mediterranea*, and Seeliger of *A. adriatica*. Great results from this study are assured in Australia where the genus *Antedon* does not occur, it being here replaced by many other genera, some of them much more favourable for study in the young stages, and others about whose development nothing whatever is known.

The composition of the Crinoid skeleton offers an interesting field for investigation. An analysis of the pinnulate arms of a specimen of *Metacrinus rotundus* from Japan showed 11% of $MgCO_3$. Fearing from the very high percentage of $MgCO_3$ that some mistake might have been made in the analysis, I had analyses made of another specimen of *Metacrinus rotundus* from Japan, and of a specimen of *Heliometra maxima* from very cold water in the Sea of Okhotsk; the former showed 10·29% of $MgCO_3$, and the latter 7%.

It has been noticed that the littoral Crinoids are more or less limited in their distribution to coast lines well supplied with fresh water, either from rain or shallow rivers; a careful statistical study of the effect of river water and rain water, especially the toxic effect of the dissolved oxygen in the latter, upon the small organisms which serve as Crinoid food, as well as a detailed study of the comparative growth of the Crinoids in areas exposed to and protected from rain, would be certain to yield results of great value. Not only on this point but on all others has the general natural history of the Crinoids been sadly neglected. We are ignorant of the limitations of their chemical, physical, and biological environment and of its influence on their size, colour, development, and local distribution; no detailed analyses have been made of the stomach contents; we do not know whether they select their food, whether each species eats the same things, or whether the food is uniform or varied or its supply intermittent or constant. The Comasterids have many-coiled intestines whereby we infer they ingest a large proportion of indigestible inorganic matter along with their food, though we do not *know* anything about it. Since the numerous coils are not found until late in post-pentacrinoid life, we assume that when young their habits resemble those of the endocyclic forms, but here again we have only a theoretical basis for our belief.

The gregarious habits of certain forms and the solitary habits of others have been explained theoretically but never studied in the field, nor is anything known about their adolescent autotomy or their relations to light, salinity, temperature, or mechanical disturbances, such as wave motion. The physiological processes, such as the digestive action, the breaking apart of the syzygies, and the significance of the water vascular system are as yet practically unstudied, as are the curious pigments, antedonin and others, and their varied and beautiful manifestations under different conditions.

In short, though the study of no group of animals gives promise of such important results, especially from a palæontological standpoint, there is no group of animals about which we know so little, and it is greatly to be hoped that the near future will see an awakening of interest which will place our knowledge of the recent Crinoids on a par with our knowledge of other recent animals, as their great importance, particularly in linking the present with the past, deserves.

History of the Subject.

The history of the study of the Crinoidea inhabiting the coasts of Australia is, considering the great importance of the region, surprisingly short. The literature dealing with the subject is all included in less than forty papers contributed by only fourteen authors; most of these papers mention Australian species only incidentally, while a few are local lists, based on small collections from single localities or from limited areas; no comprehensive work has yet appeared. Such a state of affairs necessitates a very considerable amount of labour for anyone who wishes to acquire a general idea of the subject, for all these papers must be read and a general idea formed by piecing together the more or less fragmentary bits of information gleaned from each.

Lamarck was the first author to mention any Australian Crinoid, over one hundred years after the first announcement of their occurrence in China had been made. In 1816 he described four new species, which had been obtained in Australia by Péron and Le Sueur on their memorable voyage in 1803, under the names of *Comatula adeonæ*, *C. fimbriata*, *C. solaris*, and *C. rotalaria*. The second of these is the same form which was described from China by Petiver, in 1711, as *Stella chinensis perlegens*, a reference cited by Linnæus under his *Asterias pectinata*, and is also identical with the species represented by the type specimen of Linnæus' second species, *Asterias multiradiata*, which had come from the Indian Ocean. At the same time Lamarck described his *Comatula brachiolata*, for which the habitat "Atlantic Ocean" was given, though it has since been found to be an Australian species.

Professor Johannes Müller next took up the comprehensive study of the recent Crinoids, and in 1841 published an excellent treatise on the genera and species of the Comatulids. In this five new species are described which occur on the Australian coasts, though, so far as known, none of the type specimens were actually obtained there. The first of these species, *Actinometra imperialis*, of unknown habitat, was made the type of a new genus, *Actinometra*; but later Müller discovered that it was identical with Lamarck's *Comatula solaris*, described twenty-five years before. One of the four other species is also a synonym of a form previously described by Lamarck, *Alecto rosea* being the same as *Comatula brachiolata*, and *A. timorensis* is identical with the *Alecto parvicirra* described by Müller in the same paper. *Alecto timorensis* came from Timor, but the origin of the others was unknown.

On examining the literature, Müller found two forms designated by the name *multiradiata*, supposed by their authors to be referable to the Linnæan *Asterias multiradiata*. One was the *Comatula multiradiata* of Lamarck, briefly and inadequately diagnosed in 1816, and the other the *Comatula multiradiata* of Goldfuss, well described and beautifully figured in 1832. Müller took the ground that the name must hold for the form which was recognizable from the description, that described by Goldfuss, and he redescribed one of Lamarck's original specimens under the name of *multifida*, which name he intended as a substitute for *multiradiata*, Lamarck. The *multiradiata* of Lamarck was a composite species, composed of three elements now distributed in two different genera; but its exact interpretation is a matter of very considerable importance, for it was made the type of the genus *Comaster* by L. Agassiz, in 1836. This action by Müller technically identifies the *multiradiata* of Lamarck, and gives us a definite type, *multifida*, for the genus *Comaster*. Although not originally described from Australia, *multifida* is an Australian species.

In 1843 Müller described *Alecto purpurea* from a specimen which was obtained by Preiss in Australia. This species has been commonly considered identical with the Linnæan *Asterias pectinata*, but in reality it is perfectly distinct. The type is in the Berlin Museum, and the authorities of that institution have been so kind as to allow me to borrow it, whereby I have been enabled to compare it side by side with similar specimens in the Australian Museum, and thus definitely to establish its identity and individuality.

On the 13th August, 1845, there appeared the following notice in "L'Institut," p. 292:—

"Une espèce nouvelle d'Encrine vivante a été découverte par le reverend C. Pleydell, à Newcastle, sur la rivière Hunter,

dans la Nouvelle-Hollande; l'auteur propose de lui donner le nom d'*Encrinus australis*. Elle n'a pas de colonne vertébrale, mais le corps de l'animal a environ un cinquième de pouce de long, et est terminé dans cette direction par un base circulaire. A l'extrémité opposé du corps sont attachés cinq appendices claviculaires, etc. M. Pleydell a essayé souvent de recueillir avec beaucoup de soin des échantillons complets de cet animal pour les envoyer en Europe; mais, après sa mort, les articulations ne tardent pas a s'en disjoindre et à tomber en pièces. La découverte de M. Pleydell est d'autant plus interessant que jusqu' à present on n'a encore rencontré que très rarement des echantillons un peu complets d'Encrines vivants, et encore le nombre des espèces en est-il très limité. On sait d'autre part combien sont nombreux ces animaux à l'état fossile dans presque toute la série des terrains stratifiés, jusque peut-être dans les terrains tertiare, si l'on ajoute foi aux dernières découvertes faites à ce sujet dans les terrains subapennins."

This organism could not have been a Crinoid; what it was has remained, so far as literature is concerned, a mystery.

In 1846 Müller described two species which had been brought from King George Sound in South-western Australia by MM. Quoy and Gaimard. These were *Comatula macronema* and *C. trichoptera*, which have since proved to be the most characteristic of all the Australian species, and, with the addition of another related to the first, the only ones confined to the more southern part of the Continent.

Sir Richard Owen in 1862 described, but did not name, an "encrinite" which was dredged by Mr. J. S. Poore in eight fathoms in King George Sound; it was about six inches long, with arms one and one-half inches long, and was coloured a beautiful rose or pink, fading to white. Dr. P. H. Carpenter suggested that it was possibly a pentacrinoid larva, though of most unusual size. It seems most probable, however, that this was really a small Umbellularian; one of Kölliker's figures of the young of *Umbellularia carpenteri*, taken by the "Challenger" in the seas south-west of Australia, shows an animal sufficiently like a Crinoid to deceive even a fairly skilled zoölogist, and of the size described by Owen. The colour as given is certainly suggestive of an Umbellularian, and, moreover, does not occur in any of the small stalked Crinoids, nor in any pentacrinoid larvæ.

Six years later Professor Sven Lovén announced the discovery of a recent Cystidean—a group previously supposed to be exclusively Palæozoic—at Cape York; but this was soon shown to be merely the detached visceral mass of some Comatulid having a strongly plated perisome, and later it was referred by P. H. Carpenter to *Zygometra multiradiata* which is common in that region.

In 1877 Professor E. P. Wright wrote a paper on a new genus and species of sponge, *Kallispongia archeri*, from Australia, which Ridley, then recorder for the "Zoological Record," at once suspected to be the stalked larva of some Comatulid. Wright figures two species which are probably the larvæ of *Compsometra loveni* and *Ptilometra mulleri*; he distinguishes the latter as a variety.

Dr. P. H. Carpenter two years later published his able monograph on the genus *Actinometra*, and the preliminary report on the Comatulidæ collected by the "Challenger" Expedition. The former contained nothing new in regard to Australian forms, although for the most part based upon a species which is common on the northern coast; the latter will be considered in connection with his completed monograph.

In 1881 he discussed a few Australian species, but without bringing forward any new facts in regard to the fauna of the region. At the same time he described *Antedon pinniformis* and *A. perspinosa* from New Guinea, both species which have more recently been reported from Queensland. During the following year he gave a short account of a specimen at Copenhagen which was the basis of Lütken's MS. name *Antedon australis*. This magnificent example of *Craspedometra acuticirra* had been taken at Sydney, and it remains to-day the only specimen of the species from any locality south of the Andamans and Singapore. In the same paper he described *Actinometra robusta* (Lütken MS.) and *Actinometra meyeri*, both from Australia. The former was soon recognised as the same as the Lamarckian *Comatula solaris*, while the latter he later erroneously placed in the synonymy of Müller's *Actinometra parvicirra*.

In the year 1882 Professor F. Jeffrey Bell proposed a scheme for the graphic representation of the various species of Comatulids by means of formulæ, and published a list giving most of the described forms with their appropriate formulæ. In this list he included certain MS. names of his own, in anticipation of the "Alert" Report, among them *Antedon loveni* and *Antedon insignis*, which he changed two years later to *Antedon pumila* and *Antedon loveni* for no apparent reason, greatly to the confusion of nomenclature. In addition he described as new *Actinometra annulata*, from Cape York, which was wrongly considered by Carpenter as the same as Müller's *Alecto parvicirra*.

The "Report upon the Zoological Collections made in the Indo-Pacific Ocean during the Cruise of H.M.S. 'Alert' in the years 1881-2," published in 1884, is the first paper of any length dealing mainly with Australian species. It was written by Professor F. Jeffrey Bell, but Carpenter assisted in many of the identifications. Twenty-eight species from Australian waters

are mentioned, all with definite localities; fifteen of these are described as new. Certain species described many years before by Lamarck and Müller are listed, but not redescribed, although the original descriptions are quite inadequate The species mentioned, with their identification as now understood, (those designated by an asterisk are here described for the first time) are :—

Antedon adeonæ	*Tropiometra*, sp. nov. *Oligometra adeonæ.*
Antedon milberti	*Amphimetra milberti.* *Amphimetra discoidea.* *Oligometra carpenteri.*
Antedon pinniformis... ...	*Oligometra adeonæ.*
**Antedon carpenteri*	*Oligometra carpenteri.*
**Antedon pumila*	*Compsometra loveni.*
**Antedon bidens*	*Oligometra adeonæ.*
**Antedon loveni*	*Colobometra perspinosa.*
**Antedon decipiens*	*Amphimetra variipinna.*
**Antedon reginæ*	*Dichrometra reginæ.*
Antedon articulata	*Dichrometra articulata.*
Antedon gyges	*Dichrometra gyges.*
**Antedon irregularis*	*Amphimetra variipinna.*
**Antedon elegans*	*Zygometra elegans.*
**Antedon briareus*	*Comantheria briareus.*
**Antedon microdiscus* ...	*Zygometra microdiscus.*
Actinometra solaris	*Comatula solaris.*
Actinometra albonotata ...	*Comatula solaris.*
**Actinometra intermedia* ...	*Comatula solaris.*
Actinometra robusta ...	*Comatula solaris.*
**Actinometra strota (nomen nudum).* ...	*Comatula solaris.*
Actinometra cumingii ...	*Comanthus parvicirra.*
**Actinometra coppingeri* ...	*Capillaster multiradiata.*
Actinometra jukesi	*Comatula rotalaria.*
Actinometra parvicirra ...	*Comanthus parvicirra.*
Actinometra alternans ...	*Comantheria alternans.*
**Actinometra paucicirra* ...	*Comatula rotalaria.*
Actinometra multifida ...	*Comaster typica.* *Comanthina schlegelii.*
**Actinometra variabilis* ...	*Comaster typica.* *Comaster multifida.*
? *Actinometra purpurea* ...	*Comatula pectinata.*

Several other species were collected by the "Alert," but were not determined, mostly from having being overlooked; they are chiefly represented by small specimens. While going over the "Alert" material in London, I took the opportunity of identifying these, and they are included in the systematic portion of the

present paper. It has not seemed advisable to burden the above list with references to them, as they obviously were not considered in the preparation of the report, though they are all in jars which bear on the outside a specific name.

So much has been written concerning the errors in identification and description of the various species included in this report by all subsequent authors who have had occasion to treat of Australian Crinoids that it seems unnecessary to recapitulate them here. Systematically, the chief point of interest lies in the inclusion of the first two known recent species of *Zygometra*, which, with the *Eudiocrinus indivisus* described by Semper in 1868 from the Philippine Islands, make three recent species of a family peculiarly characteristic of the Jurassic rocks of Europe.

Early in 1885 Professor Bell published a short paper on a collection of Echinoderms which had been brought from Australia to London in connection with the International Fisheries Exhibition held in that city in 1883. Among them were five species of Crinoids, together with two more from the Solomon Islands; these are, with their present status :—

Antedon milberti	...	*Amphimetra discoidea*
Antedon macronema	...	*Ptilometra mulleri*
Antedon pumila	...	*Compsometra loveni*
Actinometra solaris	...	*Comatula solaris*
Actinometra intermedia	...	*Comatula solaris*
Actinometra jukesi	...	*Comatula jukesi*

In addition there were "several species of *Antedon*, hitherto undescribed, but here unfortunately represented by single, nor always perfect specimens."

Three years later Professor Bell reported upon a collection of Echinoderms made by Mr. J. Bracebridge Wilson at Port Philip. Among these were three Crinoids, two of which he described as new. One of these, *Antedon wilsoni*, is undoubtedly the young of *Ptilometra mulleri* or of *Pt. macronema*, and the other, *Antedon incommoda*, Professor Bell himself pronounced in the following year to be the same as his earlier species *Antedon loveni* (=*Antedon pumila*), though I found, upon examining the types at London, that it is really a valid form. The remaining species was *Comanthus trichoptera*.

In the same year the "Challenger Report on the Crinoidea, Part ii. Comatulæ" was published. Although only species obtained by the "Challenger" were treated in detail, all the known Comatulids are mentioned and their habitat given.

The "Challenger" occupied five stations on the eastern and north-eastern coasts of Australia, where Crinoids were found,

securing in all thirteen species of which three were described as new(*); these are:—

Actinometra multiradiata	...	*Capillaster multiradiata*
Actinometra maculata	...	*Comatella maculata*
Actinometra paucicirra	...	*Comatula cotalaria*
Actinometra solaris ...	...	*Comatula solaris*
Actinometra pectinata	...	*Comatula pectinata*
**Actinometra belli* ...	...	*Comantheria belli*
Actinometra trichoptera	...	*Comanthus trichoptera*
**Actinometra valida* ...	...	*Comanthus annulata*
Actinometra parvicirra	...	*Comanthus parvicirra*
**Antedon multiradiata*	...	*Zygometra multiradiata*
Antedon microdiscus	...	*Zygometra microdiscus*
Antedon variipinna...	...	*Amphimetra variipinna*
Antedon macronema	...	*Ptilometra mulleri*

Thirty-one species were credited to Australia by Carpenter; these are:—

Antedon elegans	*Actinometra brachiolata*
Antedon microdiscus	*Actinometra pectinata*[7]
Antedon multiradiata	*Actinometra solaris*
Antedon carpenteri	*Actinometra paucicirra*[8]
Antedon loveni[1]	*Actinometra cumingi*[9]
Antedon milberti[2]	*Actinometra maculata*
Antedon pinniformis[3]	*Actinometra rotalaria*[10]
Antedon pumila[4]	*Actinometra valida*[11]
Antedon variipinna	*Actinometra coppingeri*[12]
Antedon adeonæ	*Actinometra multiradiata*
Antedon bidens[5]	*Actinometra alternans*
Antedon macronema[6]	*Actinometra belli*
Antedon articulata	*Actinometra briareus*
Antedon gyges	*Actinometra multifida*[13]
Antedon reginæ	*Actinometra parvicirra*[14]
Actinometra trichoptera	*Actinometra variabilis*[15]

1. A synonym of *Antedon perspinosa*, P. H. Carpenter, 1881, and of *Antedon insignis*, Bell, 1882.

2. In reality *discoidea*.

3. Based on the "Alert" Report; in reality *Comatula adeonæ*, Lamarck, 1816, misidentified.

4. A synonym of *Antedon loveni*, Bell, 1882.

5. A. synonym of *Comatula adeonæ*, Lamark, 1816.

6. Includes also *Ptilometra mulleri*.

7. Includes also *Alecto purpurea*, J. Müller, 1843.

8. A synonym of *Comatula rotalaria*, Lamarck, 1816.

9. Based on the "Alert" Report; in reality the *Alecto parvicirra* of J. Müller, 1841.

10. Not the *Comatula rotalaria* of Lamarck, 1816, but the *Alecto parvicirra* of J. Müller, 1841, to which species Carpenter inadvertently shifted Lamarck's name.

11. A synonym of *Actinometra annulata*, Bell, 1882, and of *Actinometra meyeri*. Carpenter, 1882.

12. A synonym of *Asterias multiradiata*, Linnæus, 1758.

13. Based on the "Alert" Report; under this name are included *Phanogenia typica*, Lovén, 1866, and *Actinometra schlegelii*, P. H. Carpenter, 1881.

14. Includes also *Actinometra annulata*, Bell, 1882.

15. Based on the "Alert" Report; under this name are included *Alecto multifida*, J. Müller, 1841, and *Phanogenia typica*, Lovén, 1866.

A careful analysis of Carpenter's Australian species, based on a review of his entire material, gives us the following thirty forms known to him as inhabitants of the coasts of Australia:—

Capillaster multiradiata
Comatella maculata
Comatula rotalaria
Comatula brachiolata
Comatula solaris
Comatula purpurea
Comatula pectinata
Comaster typica
Comaster multifida
Comantheria briareus
Comantheria alternans
Comanthina belli
Comanthina schlegelii
Comanthus trichoptera
Comanthus annulata
Comanthus parvicirra
Zygometra microdiscus
Zygometra multiradiata
Zygometra elegans
Amphimetra milberti
Amphimetra discoidea
Dichometra articulata
Dichrometra reginæ
Dichrometra gyges
Colobometra perspinosa
Oligometra adeonæ
Oligometra carpenteri
Ptilometra macronema
Ptilometra mulleri
Compsometra loveni

Of these, sixteen, or more than one half, belong to the Comasteridæ, three each to the Zygometridæ, Mariametridæ and Colobometridæ, two each to the Himerometridæ and Thalassometridæ, and one to the Antedonidæ; there are twenty-nine representatives of the great suborder Oligophreata, while only one is found of the Macrophreata.

In 1889 Mr. Thomas Whitelegge published a most excellent "List of the Marine and Fresh-water Invertebrate Fauna of Port Jackson and Neighbourhood," and in this list he included five species of Crinoids, all of them previously known from the region. He was able to add original notes in regard to three

of these species, *Compsometra loveni*, *Ptilometra mulleri*, and *Comanthus trichoptera*, the other two being included on the basis of the "Challenger" Report, they having been dredged by that ship at Station No. 164 off Port Jackson.

Mr. Whitelegge's list is of interest as being the first contribution to the study of the Australian Crinoids, by one who was actually acquainted with them in life; and also as giving the first definite data in regard to their breeding season.

In 1890 Dr. P. H. Carpenter identified for the Port Philip Biological Survey Committee some twenty-nine specimens of Comatulids which had been dredged by Mr. J. Bracebridge Wilson in the outer harbour at Port Phillip, and outside the Heads in the summer of 1887-8. There were five species in this collection, the most numerous being the little *Compsometra loveni*, *Comanthus trichoptera*, and *Ptilometra mulleri* were also included, while "*Antedon wilsoni*," the young of this last, and a new species of "*Antedon*" were recorded. Of this new species Dr. Carpenter remarks that, though he believes it to be a new species, "it may turn out to be only a strongly marked variety of *A. pumila*" (*i.e.*, *Compsometra loveni*). This new species is without doubt the *Compsometra lacertosa* described herein.

In 1890 Dr. E. P. Ramsay recorded some specimens of *Antedon pumila* (*Compsometra loveni*) which he obtained by dredging in Port Jackson.

The year 1891 was marked by the appearance of Dr. Clemens Hartlaub's excellent Monograph upon the Comatulid fauna of the Indian Archipelago, a preliminary notice of it having appeared in 1890, primarily a report upon the magnificent collections made by Dr. J. Brock at Amboina, but including all the known Crinoids of the Indian Ocean. In addition to *Ptilometra mulleri* from Sydney, seven Australian Comatulids are considered, four of which are here described for the first time, while one of the remaining three is new to Australia; these species are:—

Antedon nematodon (n.sp.) ...	*Heterometra nematodon*
Antedon monacantha (n.sp.) ...	*Stephanometra monacantha*
Antedon tenera (n.sp.)	*Dichrometra tenera*
Antedon afra (n.sp.)	*Tropiometra afra*
Actinometra pectinata	*? Comatula purpurea*
Actinometra brachiolata ...	*Comatula brachiolata*
Actinometra bennetti	*Comanthus bennetti*

These four new species were all obtained many years before by the ships belonging to the Godeffroys of Hamburg, and deposited in their private museum. Here they had been examined by Professor C. F. Lütken, who had bestowed MS. names upon them, but had never published any diagnoses of his new forms. After

the dissolution of the Godeffroy Company the museum was broken up and its contents scattered, mostly, however, going to various German institutions, where the specimens were accessible to Hartlaub. Lütken had negotiated many exchanges, and had sent out many specimens under the MS. names which he had applied to the various species Hartlaub is therefore to be commended for retaining Lütken's original names when describing the species, and thereby enabling those who have received specimens determined by Lütken to know what species they represent, as well as making clear the identification of the numerous *nomina nuda* occurring in the catalogues of the Godeffroy Museum.

In addition to describing and recording these various species from Australia, Hartlaub discovered that the species called by Bell in 1882 *Antedon insignis*, which name he changed in 1884 to *Antedon loveni*, is in reality the same as the form described by Carpenter in 1881 as *Antedon perspinosa*.

Professor Bell three years later published a list of the Echinoderms of North-west Australia, including eleven species of Crinoids. No definite localities are given, but he states that "the chief localities are Holothuria Bank, Magnetic Shoal, Cossack Island, and Baudin Island (14° 08′ S. lat., 125° 36′ E. long.)."

The depth alone is recorded with the various species, and the list as given is:—

Antedon milberti ...	... 8-15 fms.		*Amphimetra discoidea* *Oligometra carpenteri*
Antedon serripinna ...	...24-39	„	*Oligometra carpenteri*
Antedon variipinna	... 9-38	„	*Amphimetra variipinna*
Antedon, sp. (near *macronema*)	?		*Cenometra cornuta*
Actinometra pectinata	...20-36	„	*Comatula pectinata* *Comatula purpurea*
Actinometra nobilis	... 65	„	*Comanthina belli*
Actinometra paucicirra	... 8-15	„	*Comatula rotalaria*
Actinometra parvicirra	... 9	„	*Comatula pectinata* *Comantheria briareus*
Actinometra variabilis	... 9-38	„	*Comanthus parvicirra*
Actinometra multifida	... ?		*Comaster typica* *Comanthina belli*
Actinometra multiradiata	... ?		*Capillaster multiradiata*

It is impossible to question the accuracy of a list of this nature no matter how suspicious one may be of some of the records; but fortunately I was able to review Professor Bell's material during my visit to London, and to reidentify all of the specimens.

In 1898 Professor Ludwig Döderlein published an account of a collection of Crinoids from Amboina and Thursday Island; the species recorded by him, with their present identification are:—

Antedon elegans ...	... *Zygometra elegans*
Antedon microdiscus	... *Zygometra microdiscus*
Antedon bidens ...	... *Oligometra adeonæ*
Antedon ludovici ...	... *Craspedometra acuticirra*
Antedon imparipinna	... *Dichrometra protectus*
Actinometra pectinata	... *Comatula pectinata*
Actinometra solaris ...	... *Comatula solaris*
Actinometra paucicirra	... *Comatula rotalaria*
Actinometra belli ...	... *Comaster multifida* *Comanthina belli*
Actinometra parvicirra	... *Comanthus annulata* *Comanthus parvicirra*
Actinometra regalis	*Comanthina schlegelii*

The Australian Crinoid Fauna.

As known to-day the Crinoid fauna of the littoral and sublittoral zones about the continent of Australia (including Tasmania) is composed of forty-six species, included in nineteen genera and nine families; eight of these families, including eighteen of the nineteen genera, belong to the suborder Oligophreata. Twenty of the species and one of the genera are only known from Australia; but the latter is closely allied to two other genera characteristic of the East Indian region.

The proportionate frequency of the genera and species in the several families is entirely different from what is found in other parts of the world. The Comasteridæ are represented by five genera and nineteen species, five of which have not been found elsewhere; the Zygometridæ, though represented by only one of the three genera, include three species, all peculiar to Australia; only two other recent species of this genus are known; the Himerometridæ are represented by three genera, while the families Mariametridæ and Stephanometridæ have one each; all of the four genera of Colobometridæ inhabit Australia, one of the genera including three Australian species. There are two Australian genera of Tropiometridæ, one of which is not known elsewhere; the great family Thalassometridæ, which includes sixteen genera and very numerous species, is represented by three species; and the very large cosmopolitan family Antedonidæ, containing nearly twenty-five genera, includes but a single genus in Australian waters, with two species, neither of them known elsewhere.

The great majority of the Australian Crinoids are tropical species which have extended their range southward from the East Indian region, and they are therefore limited to the coast of

Queensland on the east, and the coast north of Dirk Hartog Island on the west. The southern coasts are tenanted by seven species peculiar to Australia, but belonging to one endemic and four tropical genera, which lend to that region an aspect very characteristic, and yet at the same time without any especial zoögeographic significance.

The extent of the intrusion of the various tropical species into Australian territory varies greatly, though possibly much of this apparent variability is due to the present lack of accurate knowledge.

On the eastern coast the following species are not known to occur except at Cape York, or in the immediate vicinity of that peninsula :—

Comaster multifida
Comanthina belli
„ *schlegelii*
Zygometra multiradiata
Stephanometra monacantha
Dichrometra gyges.

Flinders Island is the southern limit of :—

Capillaster multiradiata.

Port Denison represents the furthest south attained by :—

Comatula purpurea
Comantheria briareus
Comanthus bennetti
Stiremetra arachnoides.

Bowen limits the range of :—

Comatella maculata
Comanthus valida
Heterometra nematodon
Dichrometra tenera
Tropiometra afra.

South of Port Molle the following are not found :—

Comanthus parvicirra
Comatula rotalaria
Comaster typica
Comantheria alternans
Zygometra microdiscus
Amphimetra discoidea
„ *milberti*
Dichrometra articulata
„ *reginæ.*

The following are not known south of Port Curtis :—

Comatula solaris
Zygometra elegans
Amphimetra variipinna
Heterometra bengalensis
Oligometra carpenteri
,, *adeonæ.*

The tropical species extending to Port Jackson, or to Sydney are :—

Comatella stelligera
Comatula pectinata
Colobometra perspinosa.
Craspedometra acuticirra.

There are seven species confined to the southern part of Australia, all peculiar to the region ; these are :—

Comanthus trichoptera
Comatula brachiolata
Ptilometra macronema
,, *mulleri*
Compsometra loveni
,, *incommoda*
Oligometra thetidis.

And they have the following distribution :—

Comatula brachiolata :—King George Sound east to Port Phillip.

Comanthus trichoptera :—Tasmania ; King George Sound east to Port Jackson.

Ptilometra macronema :—Dirk Hartog Island to King George Sound, and east to Kangaroo Island, and to Port Phillip.

Ptilometra mulleri :—Port Phillip to Newcastle and Port Stephens.

Compsometra loveni :—Port Phillip, north to Claremont Island, Queensland.

Compsometra incommoda :—Port Phillip to Port Jackson.

Nothing whatever is known of the Australian range of the following species :—

Tropiometra encrinus.

The data in regard to the range of the species inhabiting the west coast of Australia are so unsatisfactory as scarcely to warrant recapitulation. The following are recorded from North-western Australia :—

Capillaster multiradiata
Comaster typica

Comaster multifida
Comatula rotalaria
,, *pectinata*
Comanthina belli
Comanthus parvicirra
Amphimetra variipinna
,, *discoidea*
Oligometra carpenteri
,, *adeonæ.*

From Nicol Bay we know :—
Zygometra microdiscus.

From Mermaid, etc. :—
Comantheria belli
Zygometra microdiscus
,, *elegans.*

From off Port Walcott :—
Comaster typica
Comantheria briareus.

From Dundas Strait :—
Comatula pectinata
Oligometra adeonæ.

From Holothuria Bank :—
Comatula rotalaria
,, *etheridgei*, sp. nov.
Heterometra bengalensis.

From Baudin Island :—
Comatula etheridgei, sp. nov.
,, *pectinata*
Comanthus parvicirra
Zygometra elegans
Amphimetra variipinna
Cenometra cornuta, sp. nov.
Oligometra carpenteri
,, *adeonæ.*

From Fremantle :—
Comanthus parvicirra.

From Shark Bay :—
Comatula pectinata
,, *purpurea.*

And from Turtle Bay, Dirk Hartog Island :—

Capillaster multiradiata
Decametra studeri
Ptilometra macronema.

In short it may be said that from the point of view of the Crinoids the coasts of Australia form an integral part of the great Indo-Pacific-Japanese faunal region. With its area of maximum intensity lying within a triangle whose apices are roughly Luzon, Borneo, and New Guinea, this faunal region extends southward, embracing the northern coasts of Australia, and down either side of that Continent, becoming progressively more and more attenuated as one proceeds southward, reaching Shark Bay on the west and Sydney on the east coast. At these points it undergoes a transformation, and a fauna is evolved which, while strictly East Indian, is at the same time characteristically Australian, so that the southern coasts of Australia north to Shark Bay and Sydney may be said to constitute a *South Australian* subregion, characterized by one peculiar genus (closely related, however, to two East Indian genera) and seven peculiar species distributed among five genera, the one just mentioned *(Ptilometra)* and four others, all of which extend northward to China or Japan.

I have said that the fauna of the Australian coasts north of Sydney and Shark Bay belongs to the Indo-Pacific-Japanese region; that is, it is made up entirely of Indo-Pacific-Japanese genera and species. It has, however, a curious entity of its own, a composition which at once distinguishes it from the fauna of any other district, and renders it possible to recognize a collection of Crinoids from any part of the region at once as being Australian.

Among the Comasteridæ there are four species peculiar to North Australia; these are :—

Comatula rotalaria
Comatula etheridgei
Comatula purpurea
Comanthina belli

And, strangely enough, they all represent extreme types.

The genus *Zygometra* includes in this region three peculiar species :—

Zygometra microdiscus
Zygometra multiradiata
Zygometra elegans

And, most singularly, these are the three most specialized species, with the largest number of arms in the genus.

The genus *Oligometra* here, from the widely spread *serripinna* stock, produces an entirely distinct species, *O. carpenteri*, which, again, is the extreme form of the genus, and from a somewhat different branch (from which *O. thetidis* is also derived), *O. adeonæ*.

But perhaps as significant as the occurrence of all these extreme forms is the absence of many genera which we are accustomed to consider as an integral part of the fauna of the Indo-Pacific-Japanese region. In the Comasteridæ, *Cominia* and *Comissia* are lacking; in the Zygometridæ *Eudiocrinus* and *Catoptometra* are not found; the families Pontiometridæ and Calometridæ are absent; in the family Himerometridæ we fail to find *Himerometra;* in the Mariametridæ, *Mariametra* and *Selenemtra;* in the Stephanometridæ, *Oxymetra;* in the Colobometridæ, *Cyllometra;* in the Thalassometridæ *Asterometra* or *Pterometra;* in the Antedoninæ, *Mastigometra* or *Iridometra;* the subfamilies Perometrinæ, Zenometrinæ, Heliometrinæ, and Thysanometrinæ are not represented at all, though they include seven genera abundantly represented in the shallow waters of the East Indies.

While undoubtedly further investigation will fill some of these gaps, still there are so many of them that their significance cannot be denied; the rich East Indian fauna in spreading southward has been modified, first by a selective weeding out of its component genera and species, which has been in part compensated by a development into extreme species of genera from other stock.

This process has given the North Australian fauna as compared with the parent East Indan stock a curiously unbalanced aspect; the Comasteridæ and Zygometridæ are over-developed to the great detriment of the other groups, especially of the Macrophreata; and on the whole this change has been sufficient to entitle the Australian coasts from Shark Bay and Sydney northward to rank as a separate subregion of the general Indo-Pacific-Japanese region which may be called the *North Australian Subregion*, to which the South Australian Subregion must be subordinated as a daughter division.

The North Australian Subregion is the equivalent of the Japanese, the South-east African, and the North-east African Subregions, and, like them, is the result of an adaptation to diverse environments of a common stock, the component species of which have in each case been sifted out and modified in a different way.

But there is this important difference in respect to the Crinoids of the Australian Subregion as compared with the other subregions of the great Indo-Pacific area; the peculiar species are always differentiated by an exaggeration of the specific characters. A fauna in its infancy is characterized by an enormous diversity

among the individuals of all the component species, such a state of affairs as we find to-day in the Behring Sea; at maturity we find that the fauna has crystallized into definite fixed and stable (usually new) species, some of which generally indicate new generic types showing obvious relationships with the genera of other regions. In senescence there occurs what has aptly been termed an "explosion" of specific characters which is more or less general among the component species regardless of the groups to which they may belong, and may result in the sudden origin of erratic generic types. Speaking in terms of faunistic ontogeny, the Crinoid fauna of Australia is a Crinoid fauna in senescence, the oldest Crinoid fauna to be found in the recent seas. It came originally from the northward, from the region of the great East India islands; but the fauna of these islands has been at various times rejuvenated, probably through geological processes resulting in changes in the land and water distribution, while that of Australia has been allowed to pass peacefully into old age. The past European fauna (or more exactly that part of it which is comparable to the existing faunas) was senescent, like the present fauna of Australia; the fauna of Eastern Africa is approximately at maturity; that of the West Indies and the north-western coast of Africa is young, not having reached maturity, while that of southern Japan is younger still. The Arctic Crinoids indicate a fauna at maturity, composed of definite fixed types; but the Antarctic fauna is not so old, and the Antarctic extension northward to the Behring Sea presents, at least north of the tropics, all the evidences of youth.

One cannot consider the recent Crinoids of Australia without speculating upon the possible evidence afforded in regard to the past distribution of land and sea. It is not the place here to enter into a detailed discussion of the East Indian and Indian Ocean Crinoid fauna, but a study of that fauna brings out many points of the greatest interest to the Palæontologist. What was essentially the North Australian fauna existed in Europe; it reached Europe by passage from the northern part of the Bay of Bengal north of what is now India. Geological changes have turned the sea between the Bay of Bengal and the Atlantic into land, resulting in the extirpation of all but two of the genera, *Antedon* and *Leptometra*, which have been able to survive, and flourish to-day on the east Atlantic shores and the Mediterranean, the only living survivors of the rich fauna that reached Europe by the ancient inland sea. It is most extraordinary that these two genera should have undergone so little change as to make them barely separable from the far distant *Mastigometra* and *Psathyrometra* from which they have been derived.

At the time when the various tropical Australian genera reached Europe, other genera, more hardy, pushed northward

from the main line across Russia, gradually adapting themselves to the conditions obtaining in the comparatively rigorous north ; with the closing of the sea connection behind them these genera, *Heliometra* and *Hathrometra*—at the present time still closely related to their parent East Indian genera *Cyclometra* and *Trichometra*—became fixed as an Arctic fauna, and as such survive to-day.

Besides this open sea connection with Europe and with the Arctic Ocean, certain land connections (not necessarily above the surface of the sea) are unmistakably indicated by the recent Crinoids.

The adaptable genus *Cyclometra*, in addition to sending a branch to the northward, sent one southward from Australia which became acclimated and took on much the same characters as the northern branch, differing in almost the same way from the parent stock. This formed what I have previously considered as the Antarctic species group of *Heliometra*, but which I now think it would be better to recognize as a separate genus under the name of *Solanometra* (with the genotype *Antedon antarctica*, P. H. C.), and also, by a meristic variation resulting in the doubling of all the radials and the consequent possession of twenty instead of ten arms, *Promachocrinus*. At this time southern South America was connected with the Antarctic land, and thus *Solanometra* obtained a foothold on the western coast of that continent. Finding no barriers to its dispersal, it spread rapidly northward, dipping downward when passing under the tropics (not here recorded from water shallower than 286 fathoms) and reaching the Aleutian Islands, Kamchatka, and Northeastern Japan.

There was also a land stretching from southern India southwestward to Madagascar by which the Crinoids reached Southeastern Africa ; there was no southern portion of Africa, but the Crinoids followed the southern boundary of a land which reached, in a general way, from southern British East Africa to Morocco (or some point in northern West Africa) and thence to and including the West Indies, the coast highlands of Venezuela and Columbia, southern Central America, and possibly the Galapagos Islands.

A few innovations in classification have been incorporated in this Report which seem to be called for by recent accessions to our knowledge. The family Tropiometridæ, including the genera *Tropiometra*, *Calometra*, *Ptilometra*, *Pterometra*, and *Asterometra*, has proved to be quite artificial. It is true that the species of all these genera agree in having the muscles very greatly reduced and the arms ending very abruptly as if broken off, but I find

upon close study that the muscles have been reduced from three distinct original types, while the abbreviated arm tips occur in one of the genera of the Thalassometridæ. I have therefore retained the family Tropiometridæ as covering *Tropiometra* only, a curious genus with no very close affinities, created a new family Calometridæ containing four new genera for the numerous species which I formerly placed in *Calometra*, and placed *Ptilometra*, *Pterometra*, and *Asterometra* in the Thalassometridæ where they undoubtedly belong. The Charitometridæ I have made a family instead of a subfamily, of equal rank with the family Thalassometridæ (formerly the subfamily Thalassometrinæ).

Recent discoveries have shown that the Zygometridæ are not nearly so sharply differentiated from the so-called Himorometridæ as was previously supposed, and it has seemed best to discard the latter family altogether, raising the three subfamilies previously included within it to family rank.

Explanation of Terms.

In the description of a Comatulid the number of the cirri is expressed by Roman numerals, and the number of their component segments by Arabic; thus "cirri XVII, 25" means that the animal has seventeen cirri, each with twenty-five segments.

The division series are indicated by the letters "Br" preceded by the number of the series, expressed in Roman numerals; thus "IBr" signifies the first division series following the radials, the "costals" of P. H. Carpenter's terminology in his later works, and the "second and third radials" of the "Challenger" Reports; "IIBr" is equivalent to "distichal series," "IIIBr" to "palmar series," "IVBr" to "post-palmar series," etc. The individual elements of the division series are indicated by so-called inferior numbers; thus IIBr2 means the "second distichal" or the second ossicle of the second division series.

The presence of a syzygy is indicated by the use of the symbol "+"; thus "IIBr4(3+4)" means that the second division series is composed of four ossicles, of which the third and fourth are united by syzygy.

The outer pinnules of an arm are numbered in regular sequence, P_1, P_2, P_3, etc.; the inner pinnules are lettered P*a*, P*b*, P*c*, etc. The IBr or "costal pinnule" (only found in the genus *Eudiocrinus*) is distinguished as Pc, the IIBr or "distichal pinnule" as PD, the IIIBr or "palmar pinnule" as PP, the use of these inferior capitals serving to differentiate these pinnules from those of the inner side of the arm.

Keys to the Families, Genera, and Species of Australian Crinoids.

The following keys have been arranged so as to make as easy as possible the work of identifying Australian Crinoids. The most obvious and most readily comprehended differential characters have been employed, regardless of their systematic value. Besides general keys, I have included keys based upon the extent and character of the arm division which, although purely a matter of secondary significance, offers possibly the best criteria to those not especially familiar with these animals for the identification of the various genera and species.

It must be borne in mind that the young of all multibrachiate Comatulids have ten arms only, and that, therefore, these keys are not adapted to them. In general there will be no difficulty in identifying the young by comparison with adult specimens of the species inhabiting the localities where they are found; but in the Tropiometridæ and Thalassometridæ the young differ widely from the fully grown, and great caution must be used in their determination.

Key to the Families and Subfamilies of Crinoids inhabiting the Coasts of Australia.

a^1. Proximal pinnules furnished with a terminal comb; mouth usually marginal or submarginal, anal tube central (10-160 arms)... ... *Comasteridæ.*

a^2. Proximal pinnules without terminal comb; mouth central, anal tube marginal.

b^1. I Br united by pseudo-syzygy (5-100 arms)..... *Zygometridæ.*

b^2. I Br united by synarthy.

c^1. P*a* absent (10-30 arms)..... *Colobometridæ.*

c^2. P*a* present.

d^1. All the pinnules cylindrical and very slender; P_1 twice as long as the next following pinnules; all the pinnules are composed of much elongated segments (10 arms)..... *Antedonidæ.*

d^2. Some of the lower, or all the pinnules prismatic, or some of the lower pinnules enlarged and stout; P_1 smaller than P_2; or, if larger, strongly prismatic.

e^1. The pinnules, at least those in the lower portion of arm, triangular.

f^1. All the pinnules strongly prismatic; cirri very long, the outer segments short and bearing dorsal spines; P_1 similar to P_2 but smaller, or much enlarged and strongly prismatic (10-30 arms)... ..... *Thalassometridæ.*

f^2. The distal pinnules slender and cylindrical, shorter than the triangular middle pinnules; cirri short and stout, the distal segments without dorsal processes; P_1 similar to P_2, but slightly shorter and more delicate (10 arms)..... .. .. *Tropiometridæ.*

e^2. All the pinnules cylindrical.

f^1. Brachials in distal part of arm exceedingly short and discoidal (10-40 arms).....*Himerometrinæ.*

f^2. Brachials in distal part of arm wedge-shaped and not particularly short.

g^1. The outer cirrus segments bear dorsally paired dorsal spines, or one or two denticulate transverse ridges (10-40 arms)..... .....*Colobometridæ.*

g^2. The outer cirrus segments are longitudinally carinate dorsally, or bear single median dorsal spines.

h^1. II Br 4 (3+4).....*Himerometridæ.*

h^2. II Br 2.

i^1. P_2 very stiff and spine like, with eighteen or fewer segments.....*Stephanometridæ.*

i^2. P_2 flagellate distally, with more than twenty segments.....*Mariametridæ.*

KEY TO THE GENERA OF THE COMASTERIDÆ.

a^1. Combs not confined to the proximal pinnules, but occurring at intervals all along the arm; proximal pinnules slender; mouth but slightly excentric.....*Comaster.*

a^2. Combs confined to the proximal pinnules; proximal pinnules stouter than those succeeding.

b^1. II Br 4 (3+4); always more than 10 arms.....*Comanthus.*

b^2. II Br 2, or lacking; 10 or more arms.

c^1. Middle pinnules stout, with segments which are very much broader than long; I Br apparently united by syzygy; if more than ten arms, cirri are absent.....*Comatula.*

c^2. Middle pinnules not enlarged, composed of approximately squarish segments; I Br united by synarthry; twenty or more arms; cirri well developed.....*Comatella.*

KEY TO THE GENERA OF THE COLOBOMETRIDÆ.

a^1. Pa absent.

b^1 All the pinnules very stiff, with very spinous distal ends to the segments; all the lower pinnules enlarged; cirrus segments, or P_2 and P_3, with very spiny ends, forty or more in number.....*Colobometra.*

b^2. P_2 only enlarged and stiffened; cirrus segments with smooth ends, less than twenty in number.

c^1. More than ten arms.....*Cyllometra.*

c^2. Ten arms.....*Decametra.*

a^2. Pa present.

b^1. Ten arms; 20 or less cirrus segments, the outer with dorsal transverse ridges.....*Oligometra.*

b^2. More than twenty arms; more than 30 cirrus segments, the outer with paired dorsal spines.....*Cenometra.*

KEY TO THE GENERA OF THE THALASSOMETRIDÆ.

a^1. Ten arms; cirri arranged in ten columns on a rather small columnar centrodorsal; P_1 larger and stouter than P_2.. .*Stiremetra*

a^2. More than ten (usually 15-20) arms ; cirri irregularly arranged, or arranged in fifteen closely crowded columns, on a large columnar centrodorsal ; P_1 smaller than P_2 ....*Ptilometra.*

KEY TO THE GENERA OF THE HIMEROMETRIDÆ.

a^1. Distal brachials exceedingly short and discoidal ; arm bases very rugged..... .....*Amphimetra.*

a^2. Distal brachials wedge-shaped and not especially short ; arm bases smooth.

b^1. II Br 4 (3+4).

c^1. Cirri long, stout basally but gradually tapering to a point distally..... .....*Craspedometra.*

c^2. Cirri moderate, not tapering distally..... ...*Heterometra.*

THE FOLLOWING FAMILIES ARE REPRESENTED IN AUSTRALIAN SEAS BY BUT A SINGLE GENUS EACH.

Zygometridæ ; Tropiometridæ ; Stephanometridæ ; Mariametridæ ; and Antedonidæ.

KEY TO THE GENERA OF AUSTRALIAN CRINOIDS CONTAINING SPECIES WITH TEN ARMS ONLY.

a^1. Lower pinnules provided with a terminal comb ; mouth excentric, anus central or nearly so..... .....*Comatula.*

a^2. Lower pinnules without terminal combs ; mouth central, arms marginal.

b^1. P*a* absent.

c^1. All the pinnules very stiff ; cirri long, with more than forty segments..... .....*Colobometra.*

c^2. Only P_2 stiffened ; cirri short, with less than twenty segments ....*Decametra.*

b^2. P*a* present.

c^1. All the pinnules sharply triangular, the first much enlarged.....*Stiremetra.*

c^2. All, or at least the distal pinnules, cylindrical.

d^1. P_1 twice as long as P_2..... ....*Compsometra.*

d^2. P_1 shorter than P_2.

e^1. The lower pinnules bear stout processes on the segments..... .... *Oligometra.*

e^2. The lower pinnules do not bear processes on the segments.

f^1. Cirri slightly tapering distally, rather slender, with processes on the dorsal side of the distal segments ....*Amphimetra.*

f^2. Cirri stout and smooth, not tapering distally .....*Tropiometra.*

KEY TO THE GENERA OF AUSTRALIAN CRINOIDS CONTAINING SPECIES WITH MORE THAN TEN ARMS, WHOSE DIVISION SERIES ARE ALL OF TWO OSSICLES EACH.

a^1. The proximal pinnules bear terminal combs ; mouth marginal or submarginal ; anus more or less central.

b^1. Cirri absent ; elements of division series apparently united by syzygy..... ....*Comatula.*

b^2. Cirri present; elements of division series united by synarthry ..... *Comatella.*

a^2. The proximal pinnules do not bear terminal combs; mouth central; anal tube marginal.

b^1. Pinnules triangular..... *Ptilometra.*

b^2. Pinnules cylindrical.

c^1. P_2 much enlarged, abruptly larger than P_1 or P_3, which latter resemble P_4, stiff and spinelike; the division series are well separated, and their component ossicles have broad ventrolateral processes.

d^1. Cirrus segments subequal, all much broader than long, the outer with paired dorsal spines ..... *Cenometra.*

d^2. Earlier cirrus segments (except the basal) longer than broad, but becoming shorter distally; outer cirrus segments without dorsal processes..... *Stephanometra.*

c^2. P_2 not greatly, if at all, larger than P_3, which latter is considerably larger than P_4; enlarged proximal pinnules flagellate, with very numerous segments; division series in close lateral apposition, and usually laterally flattened, without ventrolateral processes on the component segments..... *Dichrometra.*

KEY TO THE GENERA OF AUSTRALIAN CRINOIDS CONTAINING SPECIES WITH MORE THAN TEN ARMS WHOSE II BR SERIES ARE 4 (3+4).

a^1. The proximal pinnules bear terminal combs; mouth more or less excentric, anus more or less central.

b^1. Combs occur at intervals along the distal pinnules; proximal pinnules slender; mouth nearly central..... *Comaster.*

b^2. Combs confined to the proximal pinnules, which are stouter than those succeeding; arms nearly or quite central..... *Comanthus.*

a^2. Proximal pinnules without terminal combs; mouth central, anus marginal.

b^1. I Br united by pseudosyzygy; disk completely plated.... *Zygometra.*

b^2. I Br united by synarthry; disk unplated.

c^1. Distal brachials exceedingly short and discoidal; arm bases rugged and tubercular; lateral processes on the segments of the proximal pinnules..... *Amphimetra.*

c^2. Distal brachials wedge-shaped, not especially short; arm bases smooth; no lateral processes on the lower pinnules.

d^1. Cirri long and smooth, stout basally and tapering evenly to a point ..... *Craspedometra.*

d^2. Cirri shorter, not tapering distally, the outer segments strongly carinate or spinous dorsally..... *Heterometra.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS COMATELLA.

a^1. About twenty arms; cirri small, with 15-20 segments (*Queensland*)..... *C. maculata.*

a^2. About thirty arms; cirri well developed; with 20-26 segments (*Queensland; New South Wales*)..... *C. stelligera.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS COMATULA.

a^1. Twenty arms; cirri absent.

b^1. All the arms of equal length (*N.* and *N. W. Australia*)... *C. rotalaria.*

b^2. The outer arms on each radius averaging only half as long as the inner arms (*N. W. Australia*).....*C. etheridgei*, sp. nov.

a^2. Ten arms ; cirri present.

b^1. Thirty or more very short cirrus segments (*Southern Australia*).....*C. brachiolata*.

b^2. Less than twenty-five cirrus segments, which are of moderate length.

c^1. Eighteen or more cirrus segments (*Queensland* and *N. W. Australia*).....*C. solaris*.

c^2. Fifteen or less cirrus segments.

d^1. Cirri occurring all round the periphery of the centrodorsal (*Queensland* and *N. W. Australia*).....*C. pectinata*.

d^2. One or two cirri in each interradial angle (*Queensland* and *N. W. Australia*).....*C. purpurea*.

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS COMASTER.

a^1. Less than fifty arms (*Queensland* and *N. W. Australia*).....*C. multifida*.

a^2. Usually eighty or more arms (*Queensland* and *N. W. Australia*).....*C. typica*.

KEY TO THE SUBGENERA OF THE GENUS COMANTHUS.

a^1. III Br 2, rarely 4 (3+4).....*Comantheria*.

a^2. III Br 2 externally, 4 (3+4) internally.....*Comanthina*.

a^3. III Br 4 (3+4), rarely 2.....*Comanthus*.

KEY TO THE AUSTRALIAN SPECIES OF THE SUBGENUS COMANTHERIA.

a^1. IV Br and following series 4 (3+4) (*Queensland; N. W. Australia*).....*C. briareus*.

a^2. IV Br series 4 (3+4), V Br series 2, VI Br series 4 (3+4) (*Queensland*).....*C. alternans*.

KEY TO THE AUSTRALIAN SPECIES OF THE SUBGENUS COMANTHINA.

a^1. IV Br and following series 4 (3+4) ; the proximal pinnule segments do not bear dorsal processes (*Queensland*).....*C. schlegelli*.

a^2. IV Br and following series 2; the proximal pinnule segments have strong dorsal processes (*Queensland* and *N. W. Australia*).....*C. belli*.

KEY TO THE AUSTRALIAN SPECIES OF THE SUBGENUS COMANTHUS.

a^1. Cirri long and stout, the segments thirty or more in number, subequal, the distal without dorsal processes ; eighty to one hundred and twenty arms (*Queensland*).....*C. bennetti*.

a^2. Cirri short and slender with less than twenty-five segments, of which the proximal are more or less elongated and the distal short, or absent ; not more than sixty arms.

b^1. Forty or more arms ; cirri absent (*Queensland* and *N. W. Australia*).....*C. annulata*.

b^2. Less than thirty arms ; cirri present.

c^1. Twenty to thirty very slender cirri with nearly twenty segments ; anterior angles of axillaries produced (*N. S. Wales* and *S. Australia*).....*C. trichoptera*.

c^2. Less than fifteen cirri, which are not especially slender, with less than fourteen segments ; anterior angles of axillaries not especially produced (*Queensland* and *N. W. Australia*).....*C. parvicirra*.

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS ZYGOMETRA.

a^1. III Br series mostly, or entirely, 2.

b^1. 2 III Br series developed on each post-radial series, internally; thirty arms; thirty-five or fewer cirrus segments (? *N. Australia*).....*Z. comata.*

b^2. Numerous III Br series developed on each post-radial series, externally as well as internally; forty or more arms; forty or more cirrus segments (*N. Australia*).....*Z. elegans.*

a^2. III Br series mostly, or entirely, 4 (3+4).

b^2. 4 division series; proximal pinnules very large and stout (*N. Australia*).....*Z. microdiscus.*

b^2. 3 division series; proximal pinnules slender (*N. Australia*).....*Z. multiradiata.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS AMPHIMETRA.

a^1. More than ten arms; the proximal pinnules with strong lateral processes on the segments (*Queensland*; *N. W. Australia*)...*A. variipinna.*

a^2. Ten arms; the proximal pinnules smooth.

b^1. Cirri very stout, all the segments much broader than long, subequal (*N. W. Australia*).....*A. milberti.*

b^2. Cirri moderately slender, at least the proximal segments longer than broad (*Queensland*).....*A. discoidea.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS HETEROMETRA.

a^1. 35-55 cirrus segments, the outer half with moderately developed spines; lower pinnules not carinate; thirty-eight arms (*Queensland*).....*H. nematodon.*

a^2. 20-25 cirrus segments, the outer with long sharp spines; lower pinnules strongly carinate; eighteen or less arms (*Queensland*).....*H. bengalensis.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS DICHROMETRA.

a^1. Lower pinnules considerably larger on the outer arms of each post-radial series than on the inner, and very slender; 20-30 cirrus segments, the outer with small spines; 32-43 arms (*Queensland*).....*D. tenera.*

a^2. Lower pinnules approximately of equal size on all the arms.

b^1. P_2 longer than P_3.

c^1. P_2 not greatly larger than P_3; thirty-eight arms (*Queensland*).....*D. reginæ.*

c^2. P_2 not much longer than P_1; forty-one arms (*Thursday Island*).....*D. gyges.*

b^2. P_2 and P_3 about equal in length; 35-40 cirrus segments, the outer spiny (*Queensland*).....*D. articulata.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS OLIGOMETRA.

a^1. P_3 much the largest pinnule on the arm; the whole animal delicate and slender. P_2 with large processes on the lower segments (*Queensland* and *N. W. Australia*).....*O. carpenteri.*

a^2. P^1 the longest pinnule; the whole animal is stout.

b^1. Cirri XX, 20; two dorsal transverse ridges on each cirrus segment; genital pinnules not expanded (*N. W. Australia*, *Thursday Island*, *Queensland*).....*O. adeonæ.*

b^2. Cirri XV-XX, 15; a median transverse ridge on the dorsal side of each cirrus segment) genital pinnules expanded (*New South Wales*). ..... *O. thetidis.*

KEY TO THE SPECIES OF THE GENUS PTILOMETRA.

a^1. Proximal cirrus segments as long as or longer than broad; cirrus sockets in more or less definite columns; middle segments of proximal pinnules half again to twice as long as broad; distal pinnules with the third and following segments longer than broad (*W.* and *S. Australia*)..... *P. macronema.*

a^2. Proximal cirrus segments twice as broad as long; cirrus sockets irregularly arranged; middle segments of proximal pinnules not so long as broad; distal pinnules with the segments broader than long until the distal third (*S. E. Australia*)..... *P. mulleri.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS TROPIOMETRA.

a^1. 30 or more cirrus segments; arms perfectly smooth and evenly rounded dorsally, usually about 200 mm. long; deep violet or bright yellow (*Queensland*) ..... *T. afra.*

a^2. 25 or less cirrus segments; arms with a narrow median dorsal keel, 135 mm. or less in length; mottled violet and white, or purple and yellow (*Queensland*)..... *T. encrinus.*

KEY TO THE AUSTRALIAN SPECIES OF THE GENUS COMPSOMETRA.

a^1. Cirri slender and delicate, the segments preceding the penultimate being at least half again as long as broad..... *C. loveni.*

a_2. Cirri comparatively stout, the three or four segments preceding the penultimate being broader than long..... *C. incommoda.*

THE FOLLOWING GENERA ARE REPRESENTED IN AUSTRALIAN SEAS BY A SINGLE SPECIES EACH:—

Capillaster; Craspedometra; Stephanometra; Cenometra; Colobometra; Decametra; Stiremetra.

LIST OF THE CRINOIDS OF AUSTRALIA.

In the annotated synonymy the localities printed in heavy faced type are the type localities; those in italics are the places from which the species are reported other than the place of origin of the type-specimen.

In cases where the first reference to a species is accompanied merely by a more or less enigmatic "specific formula," or is merely a *nomen nudum*, it is omitted, and the reference substituted where the species was first adequately described. Information in regard to the early history of all the names may be found in my paper on the "Nomenclature of the Recent Crinoids,"[1] and it seems superfluous to repeat the data there given.

In the case of families and higher groups it has not seemed worth while to burden the text with references to the original place of publication, as in most cases these works are of no interest other than purely systematic. Where such references

[1] Proc. U.S. Nat. Mus., vol. 34, No. 1623, pp. 435-542.

are not given I have, however, appended the name of the student who first proposed the group name as a guide to anyone who may be interested in looking up the matter further.

Phylum **ECHINODERMATA**, *Klein.*

Subphylum **Echinodermata Heteroradiata**, *A. H. Clark.*

Class PELMATOZOA, *Leuckart.*

Subclass CRINOIDEA, *Müller.*

Order COMATULIDA, *A. H. Clark.*

Suborder OLIGOPHREATA, *A. H. Clark.*

Family COMASTERIDÆ, *A. H. Clark.*

Subfamily CAPILLASTERINÆ, *A. H. Clark.*

Genus CAPILLASTER, *A. H. Clark.*

Capillaster, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 87 (*Actinometra sentosa*, P. H. Carpenter, 1888).

Differential Characters.—The genus *Capillaster* is a very easy one to recognize, for it is the only Comatulid genus in which a pinnule is borne on the first brachial of the free arm; if III Br and subsequent series are present, these are always composed of three ossicles, the two outer united by syzygy, and the first bearing a pinnule.

Range.—*Capillaster* ranges from South-eastern Africa to Ceylon, and thence eastward and north-eastward to Northern Australia, the Philippine Islands, the Carolines, and Southern Japan.

A closely allied genus, *Nemaster*, represents it in the Caribbean Sea and on the coast of Brazil.

CAPILLASTER MULTIRADIATA (*Linnæus*).

Stella chinensis perlegens, 1711, Petiver, Gazophylacium, pl. 4, fig. 6 (*China*).

Asterias pectinata (part), 1758, Linnæus, Syst. Nat., ed. x., p, 663 (reference to Petiver, but not other references or the type specimen).

Asterias multiradiata, 1758, Linnæus, *tom. cit.*, p. 663 (type specimen at Lund., but not references cited) (INDIAN OCEAN).

Comatula fimbriata, 1816, Lamarck, Hist. Nat. des animaux sans vertèbres, vol. 2, p. 535 (AUSTRALIA).

Comatula coccodistoma, 1862, Dujardin and Hupé, Hist. Nat. des zoophytes, Echinodermes, p. 208 (*nomen nudum*) (*Madagascar*).

Comatula (*Actinometra*) *borneensis*, 1875, Grube, Jahresber. schles. Ges. vaterl. Cultur, 1875, p. 75 (NORTH BORNEO).

Actinometra coppengeri, 1882, Bell, Proc. Zool. Soc., 1882, p. 535 (FLINDERS, CLAIRMONT); 1884, Report Zool. Coll. H.M.S. "Alert," p. 168, pl. xvi., fig. B. (*idem*).

Actinometra multiradiata, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 322 (*Prince of Wales Channel, 8 fms.*); 1889, Studer, Die Forschungsreise S.M.S. "Gazelle," iii., Thiel, Zool. u. Geol., p. 195 (*19° 42·1′ S. lat., 116° 49·8′ E. long., 91·5 meters*); 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*N. W. Australia*).

Capillaster multiradiata, 1909, A. H. Clark, Zoologische Anzeiger, vol. 34, p. 364 (*Dirk Hartog I., 7 fms.*); Vidensk. Meddel fra den Naturhist. Forening i Köbenhavn, 1909, p. 134 (discussion).

Actinometra multifida, Brit. Mus., MS.

Antedon anceps, Brit. Mus., MS.

Differential Characters.—This species usually has between fifteen and twenty-five arms. It is the only Australian Comatulid in which the first brachial of the free arm bears a pinnule, and is therefore easily recognised.

Australian Records.—Known since 1816 from "Australia," it is only within comparatively recent years that exact records of locality touching the occurrence of this species in Australia have been published. The "Gazelle" obtained it in 7 fathoms at Turtle Bay, Dirk Hartog Island, West Australia, and in 19° 42·1′ S. lat., 116° 49·8′ E. long. (off West Australia) in 91·5 meters (about 51 fathoms); Bell records it from "North-west Australia"; the "Alert" dredged it at Flinders Island, Claremont, in 11 fathoms; and the "Challenger" dredged it in Prince of Wales Channel (10° 30′ S. lat., 142° 18′ E. long.) in 8 fathoms.

Distribution.—*Capillaster multiradiata* is found at Madagascar and Mauritius, and ranges from Ceylon eastward along the shores of the Indian Ocean, including the more northern coasts of Australia, occurring abundantly about all the East Indian Islands, and reaching as far as Kogoshima, Japan, and the Caroline Islands.[2]

[2] The form occurring on the south-eastern coast of Africa, and at Madagascar and Mauritius, differs slightly from the typical East Indian variety, and has been differentiated under the subspecific name of *C. m. coccodistoma cf.* Proc. U.S. Nat. Mus., vol. 40, p. 16).

Genus COMATELLA, *A. H. Clark.*

Comatella, 1908, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 52, p. 207 (*Actinometra nigra*, P. H. Carpenter 1888).

Differential Characters.—In the genus *Comatella* the division series are all of two segments each, and the first two brachials of the free undivided arm are united by a true or a pseudo-syzygy; the cirri are always present and well developed. There is never a pinnule on the first brachial.

Range.—This genus ranges from South-eastern Africa, the Maldive and Laccadive Islands to Southern Japan, the Philippines, Tonga, Samoa, Fiji, and Northern and Eastern Australia.

A very similar genus, *Neocomatella*, replaces it in the Caribbean Sea and on the Atlantic Coasts of Southern Europe and North-western Africa.

COMATELLA STELLIGERA (*P. H. C.*).

Antedon (Actinometra) tenax, Lütken, MS.

Actinometra stelligera, 1880, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 15, p. 198, pl. xii., fig. 26 (near KANDAVU, FIJI).

Actinometra notata, 1889, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 21, p. 312, pl. xxvii. (KING ISLAND, MERGUI ARCHIPELAGO).

Antedon bassett-smithi, 1894, Bell, Proc. Zool. Soc., 1894, p. 399, pl. xxiv. (MACCLESFIELD BANK, 13-36 fms.).

Comatella stelligera, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 136.

Differential Characters.—This and the following are the only Australian Comasterids in which all the division series are composed of two ossicles united by a readily discernible synarthry. The cirri are always functional and numerous. *Comatella stelligera* is easily distinguished from *C. maculata* by its more numerous (about thirty) arms and longer and stouter cirri, which have more than, instead of less than, eighteen segments.

Specimen in the Australian Museum.—The collection submitted to me included a single specimen of this species from Port Jackson, New South Wales, the first known from Australia. It is of medium size and has thirty-six arms which were originally about 90 mm. long; the cirri are xxii, 18-20, 20 mm. long. The eversion of the distal edge of the brachials is especially well marked, and there is an indication of an eversion of the distal edges of the elements of the division series.

Range.—Comatella stelligera is found from Port Jackson, N.S. Wales, to Samoa, Fiji, Tonga, the Philippine Islands and Macclesfield Bank, the Mergui Archipelago, and Ceylon.

COMATELLA MACULATA (*P. H. C.*).

Actinometra fusca, 1877, Lütken, Mus. Godeffr. Cat., vol. 5, p. 100 (*nomen nudum*), (*Bowen*). 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, pp. 306, 307 (*nomen nudum*), (*Bowen*).

Actinometra maculata, 1888, P. H. Carpenter, *tom. cit.*, p. 307, pl. lv., fig. 2 (PRINCE OF WALES CHANNEL, near CAPE YORK, *8 fms.*).

Comatella maculata, 1909, A. H. Clark, Vidensk. Meddel. fra den Naturhist. Forening i Köbenhavn, 1909, p. 138 (*Bowen*).

Differential Characters.—*Comatella maculata* is a small species with twenty arms, or somewhat fewer, about 80 mm. to 100 mm. long; the cirri are small, though numerous, and possess not more than twenty segments.

Australian Record.—Bowen.

Range.—Northern Australia to the Maldive and Laccadive Islands, and South-eastern Africa.

Remarks.—The type specimen, which I examined while in London, resembles very closely the specimen from Bowen in the collection of the Zoölogical Museum at Copenhagen, described in my report on that collection.

Subfamily COMACTINIINÆ.

Genus COMATULA, *Lamarck.*

Comatula, 1816, Lamarck, Hist. nat. des animaux sans vertèbres vol. 2, p. 530 (*Comatula solaris*, sp. nov.).

Differential Characters.—In *Comatula* the elements of the IBr series and the following division series (when present) and the first two brachials are united by what appears to be a true syzygy, though in reality it is a modified form of the more common synarthry or bifascial articulation. There are ten arms, except in three species, two of which have twenty and the third usually ten, but sometimes eleven or twelve. The cirri, which are often absent in the adults, are perfectly smooth dorsally without dorsal spines or ridges. The segments of the genital pinnules are short and very broad.

Range.—*Comatula* ranges from the Andaman Islands, Java and Singapore, including the whole of Australia, to Celebes, the Philippine Islands and Hong Kong.

A closely allied genus, *Comactinia*, represents it in the Caribbean Sea.

COMATULA ROTALARIA (*Lamarck*).

Comatula rotalaria, Hist. nat. des animaux sans vertèbres, vol. 2, p. 534 (Australia).

Actinometra jukesii, 1879, P. H. Carpenter, Proc. Roy. Soc., vol. 28, p. 390 (NORTH-EAST COAST OF AUSTRALIA).

Actinometra jukesi, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 168 (*Albany Island*; *Prince of Wales Channel*); 1885, Proc. Linn. Soc. N. S. Wales, vol. 9, p. 498 (*Port Molle*)

Actinometra paucicirra, 1884, Bell, *tom. cit.*, p. 169, pl. xvii., figs. A, A*a* (PRINCE OF WALES CHANNEL; THURSDAY ISLAND); 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 291.—1898, Döderlein, Denkschr. Ges. Jena, vol. viii., p. 479 (*Thursday Island*).

Differential Characters.—This species always has almost or quite exactly twenty arms and division series of two ossicles each, united by a pseudo-syzygy which appears exactly like a syzygy externally. When adult there are no cirri; the cirri of the young are always perfectly smooth dorsally.

Specimens in the Australian Museum Collection.—Albany Passage:—Two fine examples, one with nineteen, the other with twenty arms. *Port Molle, Queensland*:—Two specimens; one is a fine large individual with twenty arms 120 mm. long, the other a young example with twenty arms 60 mm. long, and cirri vii, 15, 11 mm. long. This specimen represents the stage figured by Bell in the "Alert" Report (pl. xvii., A); the seven cirri are confined to the interradial angles of the centrodorsal; three are single, the remaining four in two pairs; they are moderately slender; the first segment is very short, the second not quite so long as broad, the third slightly longer than broad, the fourth and following approximately equal in size, about half again as long as broad except the penultimate, which is about as long as broad; the more proximal segments are slightly constricted centrally, and the penultimate bears a small and short subterminal opposing spine; the terminal claw is half again as long as the penultimate segment, moderately and evenly curved.

The study of these specimens has shown that in this species, as in the genus *Comatella*, arm division is of the so-called "compound" type, and in *Comatula pectinata* also when a II Br series occurs the first true syzygy on the inner arm is between the first and second brachials, on the outer between the third and fourth. The very characteristic cirri, identical in small specimens of *rotalaria* and in specimens of the other species of the genus at comparable stages, which never show any trace of dorsal processes on the outer segments, and which have all the segments except the basal subequal with no transition segments, as well as the invariably ten-armed condition of all but three of the species, one of which is almost invariably ten-armed, show that *Comatula*

must be placed with *Comactinia* and *Cominia*, and that, in spite of its compound division when more than ten arms are present, it cannot be at all closely related to *Comatella*.

The occurrence of compound division both in *Comatula* and *Comatella* is comparable to the occurrence of interpolated division series consisting of two segments each in such different groups as the Pontiometridæ, Stephanometridæ, and Mariametridæ among the Comatulids and in *Endoxocrinus* among the Pentacrinites, and of extraneous division of the same type in the Comatulid genus *Capillaster* and the Pentacrinite genus *Hypalocrinus*.

Additional Australian Records.—Professor J. Bete Jukes found this species abundant on the North-east Coast of Australia; the "Alert" dredged it at Albany Island, in 3-4 fathoms, at Thursday Island, and in the Prince of Wales Channel, in 7 fathoms, and in 5-7 fathoms, as well as in Torres Strait, in 4 fathoms; Professor F. J. Bell has reported it from Port Molle, and the "Challenger" found it between Albany and Somerset Islands, off Booby Island (10° 36′ S. lat., 14° 55′ E. long.), in 6 fathoms, as well as at Cape York and the Aru Islands south of the western end of New Guinea. There are some specimens in the British Museum from Holothuria Bank, 34 fathoms.

Range.—The Aru Islands and the Northern Coast of Australia, south in Queensland to Port Molle.

Remarks.—Basing my conclusions upon the data and the figures given by P. H. Carpenter in the "Challenger" Report, I have previously used the name *rotalaria* for the species called by Müller *Alecto parvicirra;* I was therefore somewhat surprised, when studying the collections of the Paris Museum, to find that Lamarck's original material consisted of two beautiful specimens of the form called *jukesii* by Carpenter and *paucicirra* by Bell, a very different thing from the *rotalaria* of the "Challenger" Report.

COMATULA ETHERIDGEI, *sp. nov.*

Description.—In general resembling *C. pectinata;* there are no cirri, but the centrodorsal is somewhat raised above the dorsal surface of the radial pentagon.

P_1 is replaced on each arm by two brachials terminating in an axillary (morphologically an exteriorly developed IIBr series) from which springs interiorly (*i.e.*, on the side toward the original arm) a small arm two-thirds the length of a normal P_1, and externally a normal P_1.

In the type specimen the small supernumerary arms are usually about two thirds the length of the normal P_1, but they may be as long as three-fourths of the length of that pinnule; another

specimen is similar, but the supernumerary arms are rather smaller; a third specimen is similar, but the supernumerary arms are longer, reaching 20 mm., and there are a few small, slender and weak cirri, each with 12 segments.

The arm length is 70 mm.

Localities.—Holothuria Bank, 38 fathoms:—Three specimens. Baudin Island, North-western Australia:—One specimen, resembling the third mentioned above from Holothuria Bank. All the specimens are in the British Museum, and are described herein with the kind consent of Professor F. J Bell.

Remarks.—This is a most extraordinary species, appearing partially to bridge the gap between the ten-armed forms, *Comatula pectinata*, *C. solaris*, *C. purpurea*, and *C. micraster*, and the twenty-armed *C. rotalaria*.

Some time ago, basing my conclusions upon a study of the arm structure, I ventured the remark that in compound arm division the inner arms are phylogenetically the oldest; the truth of this statement is strikingly illustrated by the present species in which we find the original arms of the ten-armed stage, next to them young arms less than half as large, and exteriorly pinnules which have not yet become replaced by arms.

COMATULA BRACHIOLATA (*Lamarck*).

Comatula brachiolata, 1816, Lamarck, Hist. nat. des animaux sans vertèbres, vol. 2, p. 535 (? ATLANTIC OCEAN).

Alecto rosea, 1841, J. Müller, Archiv. für Naturgesch., 1841, i., p. 143 (UNKNOWN LOCALITY).

Actinometra brachiolata, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 380 (*Australia*). 1891, Hartlaub, Nova Acta Acad. vol. 58, No. 1, p. 107 (*Australia*).

Differential Characters.—This is an exceptionally rugged species with a large broad centrodorsal and short stout tuberculous arms. The very numerous cirrus segments, all of which are subequal and much broader than long, serve to distinguish it at once from all the other species of the genus.

Nothing is known in regard to its distribution; the two specimens upon which Müller's *Alecto rosea* is based, and which are now before me, are supposed to have come from Australia.

Remarks.—I have examined the types both of Lamarck's *Comatula brachiolata* (at Paris), and of Müller's *Alecto rosea* (sent to me from Berlin), and I find them to be specimens of the same species. A beautiful specimen in the British Museum was taken at Port Phillip, and I have seen others from the vicinity of King George Sound. It is evident, therefore, that this is a South Australian species like *Comanthus trichoptera*.

COMATULA SOLARIS (*Lamarck.*)

Comatula solaris, 1816, Lamarck, Hist. nat. des animaux sans vertèbres, vol. 2, p. 533 (AUSTRALIA).

Actinometra imperialis, 1841, J. Müller, Archiv. für Naturgesch., 1841, i., p. 140 (UNKNOWN LOCALITY).

Actinometra robusta, 1879, P. H. Carpenter, Trans. Linn. Soc. (Zool.), [2] ii., p. 86, pl. v., figs. 10-15 (AUSTRALIA); 1882, Journ. Linn. Soc. (Zool.), vol. 16, p. 517 (*Australia*); 1884, Bell, Report Zool. Coll. H.M.S. "Alert," p. 167 (*Port Curtis; Sta. 144* ["*probably Thursday Island.*"]).

Actinometra albonotata, 1882, Bell, Proc. Zool. Soc. 1882, p. 535 (ALBANY ISLAND).

Actinometra solaris, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 164 (*Warrior Reef; Prince of Wales Channel; Port Curtis; Torres Strait; Thursday Island; Albany Island*); 1885, Bell, Proc. Linn. Soc. N.S. Wales, vol. 9, p. 498 (*Port Molle*); 1888, P. H. Carpenter, "Challenger" Report, Zool., vol. 26, p. 288 (*Channel between Albany Island and Somerset, 8-12 fathoms: off Booby Island, 6 fathoms*).—1898, Döderlein, Denkschr. Ges. Jena, vol. viii., p. 478 (*Thursday Island*).

Actinometra solaris, var. *albonotata*, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 164 (*Albany Island*).

Actinometra intermedia, 1884, Bell, *tom. cit.*, p. 166 (ALBANY ISLAND); 1885, Bell, Proc. Linn. Soc. N.S. Wales, vol. 9, p. 498 (*Port Molle*).

Actinometra strota, 1884, Bell, *tom. cit.*, p. 167 (*nomen nudem*), (*Port Molle*); 1884, P. H. Carpenter, "Challenger" Reports, Zool. vol. 11, p. 67 (CAPE YORK).

Differential Characters.—*Comatula solaris* is a large and handsome species with especially broad, short jointed genital pinnules, and rather stout cirri which have from sixteen to twenty-five segments. As a rule it may be at once distinguished from *C. pectinata* by its superior size and more robust build as well as by the more numerous cirrus segments, but occasionally the two species approach each other so closely that the identification of a given specimen is more or less arbitrary.

Specimens in the Australian Museum Collection.—Port Molle, Queensland, 14 fathoms—Three specimens. Port Molle—One specimen. Masthead Island Lagoon—One specimen. No locality —Ten specimens.

Additional Australian Records.—Port Curtis, in 5-11 fathoms; Holothuria Bank; Thursday Island; Fitzroy Island; Albany Island, in 3-4 fathoms; Warrior Reef; Prince of Wales Channel,

in 5-7 fathoms; Torres Strait, littoral, and in 10 fathoms; Cape York; Port Molle, in 12 fathoms; Port Denison; channel between Albany and Somerset Islands, in 8-12 fathoms; off Booby Island (10° 36′ S. lat., 14° 55′ E. long.), in 6 fathoms.

Range.—Hong Kong, Singapore, and the Philippine Islands southward to Northern Australia, on the north-east coast extending south to Port Curtis.

Remarks.—It is very curious that this species does not occur in the broad armed and generally robust phase except along the Australian coast; specimens from Singapore and Hong Kong always, so far as known, have narrow slender arms, which are well rounded dorsally. On the other hand, the robust phase of *C. pectinata* is common throughout its range. It is not uncommon to find specimens of *C. pectinata* with three or four robust arms, the remainder being slender, and much longer, but I never saw this variation in *C. solaris*.

Lamarck's original material consisted of six fine specimens.

The fine specimen taken by the "Alert" at Port Molle has no cirri; the centrodorsal is reduced to a pentagonal plate which is not quite sunk to the level of the dorsal surface of the radials.

COMATULA PECTINATA (*Linnæus*).

Asterias pectinata, 1758, Linnæus, Syst. Nat., ed. x., p. 663 (type specimen, but not citations) (INDIAN SEAS).

Comatula cumingii, 1894, J. Müller, Abhandl. d. k. preuss. Akad. d. wiss., 1847, p. 255 (MALACCA).

Actinometra affinis, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 517 (JAVA).

Actinometra pectinata, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 165 (*Dundas Strait*).—1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 284 (*Channel between Albany Island and Somerset, 8-12 fathoms*).—1891, Hartlaub, Nova Acta Acad., vol. 58, No. 1, p. 107 (*Cooktown*). —1898, Döderlein, Denkschr. Ges. Jena, vol. viii., p. 478 (*Thursday Island*).

Actinometra solaris, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 164 (*Arafura Sea*).

?Actinometra purpurea, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 170 (*Dundas Strait*).

Actinometra echinoptera, Brit. Mus., MS.

Comatula rosularis, Brit. Mus., MS.

Actinometra parvicirra, Brit. Mus., MS.

Antedon irregularis, Brit. Mus., MS.

Differential Characters.—This is a more slender and usually smaller species than *C. solaris*, and the cirri rarely have more than fifteen segments, those of *C. solaris* possessing eighteen or over. The arms may taper evenly from the base to the tip, or they may be somewhat swollen proximally, this, however, rarely being carried to the extreme commonly seen in *C. solaris*. The segments of the genital pinnules of *C. pectinata* are longer and less broadened than those of *C. solaris*.

The ossicles of the I Br series and the first two brachials in *C. solaris* are always, so far as I have seen, united by a peculiar articulation which very closely resembles a syzygy, but which is derived from a synarthry; it is called a pseudosyzygy. These segments in *C. pectinata* may be united either by pseudosyzygy or by a more or less unmodified synarthry.

The difference in length between the grooved anterior and the ungrooved posterior arms reaches a maximum in this species, the latter being sometimes scarcely one-third the length of the former. The restriction of the ambulacra also is sometimes carried to an extreme as in the much smaller *C. micraster*, four arms being grooved and six ungrooved.

Comatula pectinata frequently occurs with eleven arms, sometimes with twelve; *C. solaris*, *C. purpurea*, and *C. micraster* have never been found with more than ten.

Specimens in the Australian Museum Collection.—Albany Passage—One fine specimen with cirri xix, 14-15, 10-12 mm. long. Port Molle—One small specimen. Port Jackson—One specimen with arms 100 mm. long, somewhat swollen basally, and cirri xvi, 11-13, 10 mm. long. No locality—Three large specimens.

Additional Australian Records.—Thursday Island, littoral, and in 4-6 fathoms; Arafura Sea; Warrior Reef, Torres Strait; Basset-Smith Bank, in 9 fathoms; Prince of Wales Channel, in 7 fathoms; Port Curtis, littoral, and down to 11 fathoms; Port Molle, in 14 fathoms; Dundas Strait, in 17 fathoms; Northwestern Australia; Cape York; between Albany and Somerset Islands; Fitzroy Island; Cooktown; Holothuria Bank, in 24-34 fathoms; northern side of Holothuria Bank, in 36 fathoms; near Cape Voltaire (14° 50′ S. lat., 125° 40′ E. long.); Baudin Island, littoral, and in 8-15 fathoms.

Range.—Singapore and the Philippine Islands southward to Australia, reaching on the east coast, Port Jackson, N. S. Wales.

Remarks.—At Singapore it is not uncommon to find specimens of this species with eleven arms, and a few have even been recorded with twelve; two of the specimens from Holothuria Bank also have eleven arms, but no other examples are known from Australia with more than ten. There are never more than ten arms in the stout phase.

An examination of the type of Müller's *Comatula cumingii* has shown it to be a young specimen of this species.

COMATULA PURPUREA (*J. Müller*).

Alecto purpurea, 1843, J. Müller, Archiv für Naturgesch., 1843, i., p. 132 (AUSTRALIA); 1910, A. H. Clark, Proc. Biol. Soc. Washington, vol. 23, pp. 95-98 (fig.) (*detailed description of the type specimen*).

Actinometra pectinata (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 165.—1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 284, pl. liii., fig. 15.

Differential Characters.—This species is very like *C. pectinata*, but may be at once distinguished by the curious arrangement of the cirri; these are segregated in the interradial angles where they occur singly or in pairs, so that they are from five to ten in number. The size of *C. purpurea* is usually much less than that of *C. pectinata*.

Through the kindness of the authorities of the Berlin Museum I was enabled to compare the specimens recorded below directly with Professor Müller's original type.

Specimens in the Australian Museum Collection.—Murray Island, Torres Strait—Thirteen specimens; the cirri are v-x (usually nearer the latter), 9-12 (usually 11-12), 6 mm. long; as in *C. pectinata* they are of two types which are quite distinct, a primitive type in which the segments, except the basal two, are subequal in length and the distal are not compressed laterally, and a more advanced type in which the distal segments are shorter than the proximal, and are laterally compressed; the arms are from 40 mm. to 50 mm. long; the median dorsal surface from the sixth brachial outward is occupied by a delicate narrow rounded ridge, more prominent than the similar ridge often seen in *C. pectinata*. Port Denison—On specimen with arms 80 mm. long and cirri viii., 10-12, 8 mm. to 10 mm. long. No locality—One fine large specimen with arms 120 mm. long and cirri vii., 14-15, 9 mm. to 11 mm. long.

Additional Australian Records.—This species was not differentiated from *C pectinata* either by Bell or by Carpenter. At the British Museum I examined specimens from Dundas Strait, in 17 fathoms; from Torres Strait; and from Dimes Island, New Guinea. It is abundant at Shark Bay.

Subfamily COMASTERINÆ, *A. H. Clark.*

Genus COMASTER, *L. Agassiz.*

Comaster, 1836, L. Agassiz, Mém. Soc. sci. nat. Neuchatel, vol 1, p. 193. (*Comatula multiradiata*, Lamarck, 1816 [not *Asterias multiradiata*, Linnæus, 1758]=*Alecto multifida*, J. Müller, 1841).

Differential Characters.—The various species of *Comaster* are most readily recognised by their peculiar type of arm division. The II Br series are 4 (3 + 4), but the following series are all 2, usually appearing as if united by syzygy; III Br series are internal in their appearance, so that, if only II Br series and III Br series are present, the thirty arms will be arranged in 1, 2, 2, 1 order; the following division series follow the internal III Br series and are developed on either side alternately, so that each I Br series appears to give off two stout trunks giving off undivided arms on alternate segments, and finally terminating in a pair of undivided arms. The presence of forty arms due to the presence of all the II Br and all the III Br series is rare, but occasionally is found; species possessing such an arm arrangement are easily recognised by the II Br 4 (3 + 4) and the III Br 2 series.

The presence of terminal combs at intervals on the outer pinnules also distinguishes the genus *Comaster* from all the other genera of the Comasteridæ.

Range.—Maldive Islands to Northern Australia, Fiji, the Philippines, and the Gilbert (Kingsmill) Islands.

COMASTER TYPICA (*Lovén.*)

Antedon stellatus, Lütken, MS.

Phanogenia typica, 1866, Lovén, Öfv. k. Vetensk. Akad. Förhandl, 1866, No 9, p. 231, fig. on p. 230, *a-h* (New Harbour, *near Singapore*).

Actinometra multifida (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert, p. 169 (*Prince of Wales Channel; Thursday Island; Torres Strait*).

Actinometra variabilis, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 169, pl. xvii., figs. B, B*a* (Thursday Island); 1894, Proc. Zool. Soc. 1894, p. 394 (*N. W. Australia, 9-38 fms.*).

Actinometra typica, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 296, pl. lvii., fig. 1.

Comaster typica, 1909, A. H. Clark, Zool. Anzeiger, vol. 34, p. 365 (*off Port Walcott*); Vidensk. Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 139.

The systematic position of the *Actinometra variabilis* described and figured by Professor Bell in the Report upon the "Alert" Collections has puzzled me considerably. Carpenter placed it in the "Parvicirra group" of "*Actinometra*," all but one of the other species of which fall into the genus *Comanthus* as now understood; but the branching of the arms as shown in Bell's figure is of a curious type exclusively confined to the genus *Comaster*. The general appearance, too, of the specimen figured by Bell is that of a species of *Comaster*.

Carpenter placed the species *typica*, *distincta*, *multibrachiata* and *novæguineæ* in his "Typica group" composed of species in which the first two post-radial ossicles ("two outer radials") are supposedly united by syzygy instead of by the usual synarthry, and the same is true of the division series, which are typically composed of two segments each. Now the occurrence of a true syzygy in these places is theoretically impossible, and I therefore seized the first opportunity of examining into the matter. I find that the union between these ossicles is in reality a modification of the primitive synarthry in the direction of the syzygy, though the dorso-ventral bar across the joint face is never entirely obliterated. All grades of perfection of this "pseudo-syzygy" may be traced, from the perfect synarthry of *Comaster multifida* to the nearly perfect syzygy of *C. typica*. The "Typica group," then, is shown to be non-existent as a natural unit. But the members of the "Typica group" all agree in their peculiar combs on the proximal pinnules; these combs are short with very long teeth, and are abruptly bent so that they do not lie in the general line of the pinnule; moreover, the combs are not confined to the proximal pinnules, but occur at intervals all along the arm to the tip, a condition quite unknown in other Comasterids. Also, the proximal pinnules are very slender instead of being long and stout. In these characters Müller's *Alecto multifida* agrees with the species in Carpenter's "Typica group," and must therefore be placed with them, together with several curious species recently described by Dr. Hartlaub and by myself; all these forms I have united under the generic name *Comaster*.

The determination of *variabilis* as a *Comaster* at once brought out the fact that there is absolutely nothing in Bell's description or figure whereby this species may be differentiated from the *Actinometra multibrachiata* described four years later by Carpenter, of which I have numerous specimens from the Philippine Islands. The chief character of the latter is the large and robust cirri, but Bell says nothing whatever about the size of the cirri of *variabilis*, and they are not shown in his figure.

I requested Professor Bell to compare the types of these two species, both of which are in the British Museum, and to inform me whether or not my suspicions as to their identity were well founded. He very courteously replied that the figures given of them appear to him "to be quite satisfactory and to show the complete difference between them. In *A. multibrachiata* the arms are free and the cirri are stout and well pronounced, while in *A. variabilis* the arms are united for a considerable distance and the cirri are either completely absent or very delicate." The figure of *variabilis*, however, shows the arms to be "free," exactly as in *multibrachiata*, and, in fact, in all the species of the genus.

The character of the cirri as given by Professor Bell, however, while it shows that *variabilis* cannot be the same as *multibrachiata*, removes all possibility of distinguishing the supposed species from *typica*, a form already known from North-western Australia, and represented in the collection of the Australian Museum from Port Molle, Queensland. From the original description and the figure, supplemented by the data which Professor Bell was so kind as to send me in correspondence, it is evident that the only course open to us is to place *Actinometra variabilis* in the synonymy of *Phanogenia typica*, of which species it is merely a slightly immature stage.

Differential Characters.—*Comaster typica* when fully grown has no cirri. The arms, which are from sixty to nearly two hundred in number, arise by a curious method of branching analagous to that found in certain fossil Crinoids; the I Br axillaries give rise to two division series; these II Br 4 (3+4) division series bear outwardly undivided arms, and inwardly a division series of 2, which, in turn give off inwardly undivided arms and outwardly a IV Br series, and so on. The general appearance is that of two stout arm trunks arising from each II Br axillary, each of these trunks giving off undivided arms on either side alternately, finally terminating in a pair of arms. No other Australian Crinoid except the following possesses this scheme of arm division. The occurrence of terminal combs at intervals all along the arm and the slenderness of the proximal pinnules, as well as the apparent syzygy between the two elements of each division series, also assist in identifying the form. Taken altogether, this is much the easiest of all the Australian Comasterids to recognize.

Specimens in the Australian Museum Collection.—Port Molle, Queensland—One small immature specimen with about fifty arms. The centrodorsal has a row of twelve cirrus sockets which in life bore functional cirri; one cirrus stump of two segments remains. The interradial lateral portion of the disk is completely plated, a character not previously reported in this species (though sometimes occurring in *C. multifida*) and possibly only found in the young, as in the young of *Comactinia meridionalis*.

Additional Australian Records.—The "Gazelle" dredged a single specimen of this species in 19° 42.1′ S. lat., 116° 49.8′ E. long. (north of Port Walcott, Western Australia), in 50 fathoms. The "Alert" dredged a specimen in Prince of Wales Channel, Torres Strait, in 5-7 fathoms, and obtained four others at Thursday Island. It has been reported by Bell from North-western Australia in from 9 to 38 fathoms.

Range.—*Comaster typica* is found from Singapore to the Philippines and Fiji, and the Gilbert (Kingsmill) Islands, and southward to Northern Australia.

COMASTER MULTIFIDA (*J. Müller*).

Comatula multiradiata (part) (not of Linnæus), 1816, Lamarck, Hist. nat des animaux sans vertèbres, vol. 2, p. 533.

Alecto multifida, 1841, J. Müller, Archiv. für Naturgesch, 1841, i., p. 147 (based on preceding).

Actinometra multifida, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 169-(*Percy Island; Albany Island; Prince of Wales Channel*); 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 29, p. 383 (*Queensland; Torres Strait*); 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*N.W. Australia*).

Actinometra variabilis (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 169 (but not reference to plate). (*Thursday Island*).

Actinometra belli, 1898, Döderlin, Denk. Ges. Jena, vol. viii., p. 479 (part), plate, fig. 4 (but not 4*a*).

Comaster carpenteri, 1908, A. H. Clark, Proc. U. S. Nat. Mus., vol. 33, p. 686.

Differential Characters.—*Comaster multifida* usually has about forty arms, the II Br series being 4(3 + 4) and the III Br series 2. This arm structure, combined with the characteristic cirri and the occurrence of terminal combs at intervals on the outer pinnules to the arm tips, make the species an easy one to recognise.

Australian Records.—This species has been reported from North-western Australia, and from Percy and Albany Islands, and Prince of Wales Channel.

Distribution.—This form ranges from Northern Australia northward to the Moluccas.

Professor Döderlein in his paper upon a collection of Comatulids from Amboina and Thursday Island has confused this species with *Comantheria belli*; in his figures, supposedly of that species, fig. 4 obviously represents *Comaster multifida*; this explains why it has not developed the characteristic carination of the pinnule segments.

In the type of *Alecto multifida*, which I examined while at Paris, there are forty-five arms; the typical scheme of arm division is as follows:—There are two II Br 4 (3 + 4) series; each of these gives off one III Br 2 series externally; the latter bear outwardly an undivided arm, and inwardly a IV Br 2 series. The elements of the III Br series are united apparently by a close synarthry which has not become metamorphosed into a pseudosyzygy as is the case in *Comaster typica*. This is probably what misled Carpenter and caused him to place this species in the "Parvicirra group" instead of next to its closest relative, *C. typica*.

In the type specimen one of the III Br series is 4 (3 + 4); there are eight IV Br 2 series, all internal; there is one V Br series. The rays are broad, and the interradial areas are heavily plated. There were about fifteen cirri present in life, the stumps remaining showing that the cirri were stout.

Comaster multifida is a curious local derivative from the comparatively wide spread *C. typica* type.

Genus COMANTHUS, *A. H. Clark.*

Comanthus, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 220; Smiths. Miscell. Coll. (Quarterly Issue), vol. 52, p. 203 (COMANTHUS INTRICATA, *sp.nov.*).

Subgenus COMANTHERIA, *A. H. Clark.*

Comantheria, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 142 (*Antedon briareus*, Bell, 1884).

Differential Characters.—The subgenus *Comantheria* has the II Br series 4 (3 + 4), the III Br series 2, and some or all of the succeeding division series 4 (3 + 4). The species are all large, with very numerous arms, and usually no cirri.

Range.—The species of *Comantheria* range from Northern Australia northward to Canton, China, and Southern Japan; they are abundant in the Philippine Islands.

COMANTHERIA ALTERNANS (*P. H. C.*).

Actinometra alternans, 1881, P. H. Carpenter, Notes from the Leyden Museum, vol. 3, p. 208 (UNKNOWN LOCALITY); 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 169 (*Port Molle*).

Differential Characters.—This species has no cirri, the II Br series are 4 (3 + 4), the III Br series 2, and the more distal series evenly divided between 4 (3 + 4) and 2, the two types more or less regularly alternating.

Australian Record—Port Molle, Queensland.

Distribution.—Philippine Islands south to Queensland, in 12-20 fathoms.

Remarks.—The type, which I examined at Leyden, has about ninety arms; the division series are regularly alternating, the II Br series being 4 (3 + 4), the III Br series 2, the IV Br series 4 (3 + 4), the V Br series 2, etc.; there are almost no exceptions to this regular alternation. The centrodorsal is in shape like an *Hippasteria*, not yet having become stellate.

COMANTHERIA BRIAREUS (*Bell*).

Antedon briareus, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 163, pl. xiv. (PORT DENISON).

Actinometra divaricata, 1888, P. H. Carpenter, "Challenger" Reports, Zool. vol. 26, p. 332, pl. lxiii., figs. 6-8 (BANDA).

Actinometra parvicirra (part), 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*N. W. Australia*).

Comanthus briareus, 1909, A. H. Clark, Zool. Anzeiger, vol. 34, p. 365 (*off Port Walcott*).

Differential Characters.—This species is readily distinguished from all the other Australian members of the genus. The absence of cirri and the very great number of arms give it a superficial similarity to *Comanthina belli* and to *Comantheria alternans;* but it differs from the former in having the III Br series all 2 and in lacking the prominent carination of the proximal pinnule segments, and from the latter in the absence or at least rarity of division series of 2 after the III Br series.

Australian Records.—*Comantheria briareus* was obtained by Dr. R. W. Coppinger of the "Alert" at Port Denison, Queensland, in 3-4 fathoms, and was dredged by the German ship "Gazelle" in 19° 42·1′ S. lat., 116° 49·8′ E. long. (north of Port Walcott, Western Australia), in 50 fathoms. There is a specimen in the British Museum with between seventy-five and eighty arms which was dredged at Baudin Island, in 8-15 fathoms.

Range.—Philippine Islands and Moluccas, south to northern Australia.

Subgenus COMANTHINA, *A. H. Clark.*

Comanthina, 1909, A. H. Clark, Vidensk. Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 142 (*Actinometra nobilis*, P. H. Carpenter, 1884).

Differential Characters.—In *Comanthina* the III Br series are 4 (3 + 4), and the III Br series are 2 externally and 4 (3 + 4) internally; the species are all large, with very numerous arms, and usually few or no cirri when adult.

Range.—The species of the subgenus *Comanthina* range from northern Australia to Ceylon and the Philippine Islands.

COMANTHINA BELLI (*P. H. C.*).

Actinometra belli, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 334, pl. lxiv., figs. 1, 2 (PRINCE OF WALES CHANNEL).—1898, Döderlein, Denk. Ges. Jena, vol. viii., p. 479, plate, fig. 4*a* (but not fig. 4), (*Thursday Island*).

Actinometra nobilis, 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*North-west Australia*).

Actinometra multifida, 1894, Bell, *loc. cit.*, p. 394 (*North-western Australia*).

Differential Characters.—*Comanthina belli*, like *Comantheria alternans* and *C. briareus*, has a very large number of arms and a rudimentary centrodorsal usually devoid of cirri; the III Br series, however, are 2 on the outer side of the rays and 4 (3 + 4) on the inner side; the subsequent divisions are usually 2; and this, taken in connection with the very prominent carination of the segments in the proximal half of the pinnules, distinguishes it at once from all other Australian Comatulids.

Australian Records.—The "Challenger" dredged this species in 10° 30′ S. lat., 142° 18′ E. long. (Prince of Wales Channel, near Cape York) in 8 fathoms. There are specimens in the British Museum from Western and from North-western Australia. There are also two unrecorded specimens from Torres Strait in the U. S. National Museum, and one in the Berlin Museum collected at Mermaid by the "Gazelle." This interesting form is not otherwise known.

COMANTHINA SCHLEGELII (*P. H. C.*).

Actinometra schlegelii, 1881, P. H. Carpenter, Notes from the Leyden Museum, vol. iii., p. 210 (? East Indies).

Actinometra multifida (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 169 (*Percy Island*).

Actinometra dissimilis, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 337 (Zamboanga).

Actinometra nobilis, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 336, pl. lxv. (Philippine Islands, 18 fms.).

Actinometra regalis, 1888, P. H. Carpenter, *tom. cit.*, p. 347, pl. lxviii. (Banda, 17 fms.).

Comanthus (*Comanthina*) *nobilis*, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i Köbenhaven, 1909, p. 143.

Differential Characters.—Like *C. belli*, this species has the III Br series 2 externally and 4 (3 + 4) internally; it differs, however, in lacking the strong carination of the earlier pinnule segments and in having the IV Br and further division series 4 (3 + 4).

Australian Record.—The "Alert" obtained this species at Percy Island, Queensland; it is not otherwise known from Australia.

Range.—Maldive to the Philippine, Caroline and Solomon Islands, south to Northern Australia.

Remarks.—An examination of the type of Carpenter's *Actinometra schlegelii* at Leyden has shown me that it is the same thing as his *A. nobilis* and *A. regalis* described seven years later. Carpenter overlooked the curious characteristic arm structure in the Leyden specimen, just as he did in the type of *A. regalis*, though it is clearly depicted in his figure of the latter. I studied the types of *A. nobilis*, *A. regalis* and *A. dissimilis* at London, and find that they are identical with *A. schlegelii* and with *A. nobilis*.

Subgenus COMANTHUS, *A. H. Clark.*

Comanthus, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 220; Smiths. Miscell. Coll. (Quarterly Issue), vol. 52, p. 203; 1909, Vidensk., Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 142 (COMANTHUS INTRICATA, A. H. Clark, 1908).

Specific group BENNETTIA, *A. H. Clark.*

Bennettia, 1909, A. H. Clark, Vidensk. Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 142 (ALECTO BENNETTI, J. Müller, 1841).

Differential Characters.—The cirri are always present and numerous, compressed distally, and usually stout, and the division series are, almost invariably, all 4 (3 + 4).

Range.—South-east Africa to Samoa, including the whole of Australia and Tasmania, and northward to Japan.

COMANTHUS (BENNETTIA) BENNETTI (*J. Müller*).

Alecto bennetti, 1841, J. Müller, Archiv. für Naturgesch., 1841, i., p. 146 (UNKNOWN).

Actinometra brachymera, 1877, Lütken, Cat. Mus. Godeffroy, vol. v., p. 100 (*Port Denison*; *Pelew Islands*).

Actinometra peronii, 1881, P. H. Carpenter, Notes from the Leyden Museum, vol. iii., p. 214 (CERAM).

Actinometra bennetti, 1891, Hartlaub, Nova Acta Acad., vol. 58, No. 1, p. 107 (*Port Denison*).

Comanthus (*Comanthus*) *bennetti*, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 147.

Differential Characters.—This species is at once known by its very large number of arms, all the division series being 4 (3 + 4),

and its large centrodorsal which bears numerous long and stout cirri with thirty or more segments which are all practically of the same size and do not develop dorsal spines or ridges.

Australian Record.—Hartlaub has examined a specimen of this magnificent species from Port Denison, which was originally in the Godeffroy Museum where it had received the MS. name *brachymera* from Professor Lütken.

Distribution.—*Comanthus bennetti* ranges from the Bay of Bengal eastward to the Pelew Islands, and south to Queensland.

Remarks.—Carpenter's *Actinometra peronii*, the type of which I examined at Leyden, is identical with Müller's *Alecto bennetti*, of which the type is in the same museum.

Professor Kœhler records *Actinometra robustipinna* from Amboina, but, judging from his description, his specimen was undoubtedly an example of this species. The type of Carpenter's *Actinometra robustipinna*, which I examined at Leyden, is a much mutilated example of some species of *Himerometra*, possibly *H. crassipinna*, and is not an "*Actinometra*" at all.

COMANTHUS (BENNETTIA) TRICHOPTERA (*J. Müller*).

Comatula trichoptera, 1846, J. Müller, Monatsber. k. preuss. Akad., 1846, p. 178 (King George Sound).

Actinometra trichopetra, 1888, Bell, Ann. and Mag. Nat. Hist., [6] vol. 2, p. 402 (*Port Phillip*); 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, pp. 345, 383 (*Port Jackson*; *Port Phillip*; *King George Sound*); 1889, Proc. Roy. Soc. Vict., vol. 2 (n.s.), p. 135 (*Port Phillip*); 1889, Whitelegge, Journ. Roy. Soc. N.S. Wales, vol. 23, p. 198 (*Port Jackson*).

Differential Characters.—This interesting species cannot well be mistaken for any other. The division series are almost invariably 4 (3+4); the axillaries have a curiously produced distal angle; the arms vary from twenty to thirty-five in number; the cirri are very numerous, confined to the margin of a thin and broad centrodorsal, and are typically very slender, with about twenty segments.

Comanthus trichoptera is the southernmost representative of an otherwise tropical family, and is exclusively confined to the eastern and southern coast of Australia and the coast of Tasmania. It is most nearly related to *C. samoana* which, however, has fewer, much shorter and stouter cirri which have fewer segments and are strongly compressed laterally toward the tip.

Specimens in the Australian Museum Collection.—Broughton Island, N.S. Wales.—Five specimens; one of these has twenty

arms 90 mm. long and cirri xxvi., 19-21, 12 mm. long; two of the others are similar with twenty-four and twenty-eight arms, another is small with sixteen arms 35 mm. long, and the last is also small. Port Jackson—Seven specimens; a typical example has twenty arms 100 mm. long and cirri xxxii., 10 mm. to 14 mm. long; three of the specimens are peculiar in having the centrodorsal very small with the dorsal pole only 2 mm. in diameter, though bearing the usual number of cirri. Watson's Bay, Port Jackson—Five specimens; one has twenty-two arms 110 mm. long and cirri xix., 18-20, 12 mm. long; another has thirty-one arms and cirri xlvi., 14 mm. long, and a third has twenty-eight arms and cirri xlii. Cape Hawke, 25-28 fathoms—Two specimens. Bottle and Glass Rocks, Port Jackson—Two specimens with the centrodorsal very small as in the three described from Port Jackson. Australia—One small specimen. Tasmania—Two specimens. No locality—One fine specimen with twenty-five arms 130 mm. long.

Additional Australian Records.—King George Sound; Port Phillip; Port Jackson; Watson's Bay, Port Jackson, "common under stones at low water."

Distribution.—Confined to Southern Australia; King George Sound eastward along the southern coast of Australia, including Tasmania, and northward on the east coast to Port Jackson.

Remarks.—It would seem as if this species offered an exceptional opportunity for some one interested in embryology and comparative development who wishes to open up a new field. No question in the whole Echinoderm subject is of such interest as the comparative development of the Crinoids, and in this line of work no study is more important than a detailed investigation of the life history of some one of the Comasteridæ. We have learned a great deal from the study of the development of *Antedon*, but there is much that we do not know yet and many of our ideas based upon that genus undoubtedly need a thorough revision in the light of new data acquired from a study of some other forms.

The type specimen of this species, preserved in the Paris Museum, is a small, but characteristic one.

Specific Group VANIA, *nov.*

Validia, 1909, A. H. Clark, Vidensk. Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 142 (*Comatula rotalaria*, Lamarck, 1816).

Differential Characters.—The cirri are few, small and weak, irregularly disposed, or entirely absent; some or all of the II Br series are 2; the remaining division series have a majority of 4 (3 + 4), a minority 2, the two types being irregular in the manner of their occurrence.

Range.—Beluchistan to northern Australia, Fiji, Tonga, and the Gilbert Islands, and northward to southern Japan.

Type Species.—*Alecto parvicirra*, J. Müller, 1841.

Remarks.—The specific group *Vania* covers exactly the same ground as was intended by the specific group *Validia* established by myself in 1909. The type of *Validia* is *Comatula rotalaria*, Lamarck, 1816, chosen on the basis of the description given by Carpenter in the "Challenger" Report. Examination of the types of *Comatula rotalaria* at Paris, however, has shown that this species is the same as the *Actinometra jukesii* and *Actinometra paucicirra* described many years later by Carpenter and Bell; therefore the name *Validia* lapses into the synonymy of *Comatula*, though it will become available if it should ever be thought advisable to separate the twenty-armed from the ten-armed species assigned to that genus.

COMANTHUS (VANIA) ANNULATA (*Bell*).

Actinometra intricata, Lütken, MS. (part), (Bowen).

Actinometra intricata (part), 1874, Lütken, Cat. Mus. Godeffroy, vol. v., p. 190 (*Bowen*).

Actinometra annulata, 1882, Bell., Proc. Zool. Soc., 1882, p. 535, pl. xxxv. (Cape York).

Actinometra meyeri, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 525 (Australia).

Actinometra valida, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 314, pl. lix., fig. 3 (Prince of Wales Channel).

Actinometra littoralis, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 346, pl. lxvii., figs. 1, 2 (Banda).

Comanthus intricata, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 220 (Bowen).

Comanthus (*Comanthus*) *valida*, 1909, A. H. Clark, Vidensk. Medd. fra den naturhist. Forening i Köbenhavn, 1909, p. 143 (*Bowen*).

Differential Characters.—This species rarely has more than one or two cirri, and usually has none; if present, they are larger and stouter than those of *C. parvicirra*, with a few more segments; they are shorter and stouter than those of *C. trichoptera* with proportionately much shorter segments. The arms are usually between forty and sixty in number; the division series are almost all 4 (3 + 4), but some are always to be found of 2, especially in the II Br series.

Specimens in the Australian Museum Collection.—Port Denison, Queensland—Two immature specimens; one has nineteen arms about 100 mm. long, the other twenty-four arms about 120 mm. long. The centrodorsal is much reduced in size.

Additional Australian Records.—The "Challenger" dredged this species in 10° 30′ S. lat., 142° 18′ E. long. (Prince of Wales Channel), in 8 fathoms, and I have recorded a specimen from Bowen, Queensland, which is in the collection of the University of Copenhagen, having been originally obtained from the Godeffroy Museum. There are two unrecorded specimens from Torres Strait in the U. S. National Museum. At the British Museum I examined specimens from Cape York, from Torres Strait, from North-eastern Australia, and from Holothuria Bank, in 34 fathoms.

Distribution.—*Comanthus valida* ranges from northern Australia northward to the Philippine Islands, eastward to the Solomon, Fiji, and Tonga Islands, and westward to Ceylon.

Remarks.—An examination of the types af Bell's *Actinometra annulata* (at London) and of Carpenter's *Actinometra meyeri* (at Hamburg) has shown that they are identical with the *Actinometra valida* described in the "Challenger" Report, and with the *Comanthus intricata* which I described in 1908. The occurrence of rather more II Br 2 series than usual in the type of *Actinometra valida* prevented Carpenter from discovering its affinities with *A. meyeri* and *A. annulata.*

COMANTHUS (VANIA) PARVICIRRA (*J. Müller*).

Alecto parvicirra, 1841, J. Müller, Archiv. für Naturgesch., 1841, I, p. 145 (UNKNOWN).

Alecto timorensis, 1841, J. Müller, *tom. cit.*, p. 145 (TIMOR).

Comatula brevicirra, 1862, Dujardin and Hupé, Hist. nat. des. Zoophytes, Echinodermes, p. 208.

Comatula simplex, 1862, Dujardin and Hupé, *loc. cit.* (*Australia*).

Actinometra trachygaster (part), 1869, Lütken, Mus. Godeffr. Cat., vol. 4, p. 125.

Actinometra intricata (part), 1874, Lütken, *idem*, vol. 5, p. 190.

Comatula mertensi, 1875, Grube, Jahresber. schls. Gesellsch. für vaterl. Cultur, 1875, p. 74 (NORTH BORNEO).

Actinometra armata, 1876, W. B. Carpenter, Proc. Roy. Soc. vol. 24, p. 451 (PHILIPPINE ISLANDS).

Actinometra polymorpha, 1877, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 13, p. 440 (PHILIPPINE ISLANDS).

Actinometra mutabilis, 1884, von Graff, "Challenger" Reports, Zool., vol. 10, p. 13.

Actinometra cumingii, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 167 (*Port Molle*).

Actinometra elongata, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 311, pl. lvii., figs. 2-4 (BANDA).

Actinometra simplex, 1888, P. H. Carpenter, *tom. cit.*, p. 311, pl. lix., fig. 1 (ADMIRALTY ISLANDS, 16-25 fms.)

Actinometra rotalaria, 1888, P. H. Carpenter, *tom. cit.*, vol. 26, p. 313, pl. lix., fig. 2.

Actinometra quadrata, 1888, P. H. Carpenter, *tom. cit.*, p. 331, pl. lxii., fig. 1 (TONGATABU REEFS, TONGA ISLANDS).

Actinometra guttata, 1891, Hartlaub, Nova Acta Acad., vol. 58, No. 1, p. 96 (in synonymy).

Actinometra variabilis (part), 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*North-west Australia*).

Comatula orientalis, 1907, A. H. Clark, Proc. U.S. Nat. Mus., vol. 33, p. 155 (new name for *Actinometra simplex*, preoccupied).

Comatula helianthus, 1908, A. H. Clark, *idem*, vol. 34, p. 440 (new name for *Actinometra elongata*, preoccupied).

Comanthus (Comanthus) rotalaria, 1909, A. H. Clark, Vidensk. Medd. fra. den naturhist. Forening i Köbenhavn, 1909, p. 144 (*Australia*).

Differential Characters.—*Comanthus parvicirra* usually has from five to fifteen cirri which are small and weak, and more or less irregularly spaced about the margin of the centrodorsal. They consist of from twelve to fifteen segments. The arms are from fifteen to forty in number, most commonly between twenty and thirty. The division series are 4 (3 + 4), but a few can always be found, usually among the II Br series, of 2. The arms rarely exceed 100 mm. in length.

Specimens in the Australian Museum Collection.—Port Molle, Queensland—Two small specimens with fifteen and seventeen arms.

There is also a typical specimen which was collected at the New Hebrides, whence the species had not previously been reported.

Additional Australian Records.—Torres Strait; Warrior Reef, Torres Strait; Port Molle, Queensland; Prince of Wales Channel (10° 30′ S. lat., 142° 18′ E. long.), in 8 fathoms; Bassett-Smith Bank, in 9 fathoms; Cape Baudin; Fremantle, West Australia.

Distribution.—*Comanthus parvicirra* ranges from Beluchistan and the Seychelles eastward along the shores of the Indian

Ocean, including the north coast of Australia, and thence to the Gilbert Islands and Southern Japan.

Remarks.—*Comatula rotalaria*, Lamarck, 1816, must be eliminated from the synonymy of this species, an examination of the types at Paris having shown it to be identical with Bell's *Actinometra paucicirra*; the *Alecto wahlbergii*, J. Müller, 1841, from South Africa, formerly considered the same as this species, is in reality very distinct, being much more like *C. trichoptera*; *Actinometra meyeri* and *A. annulata*, placed in the synonymy of this species by Carpenter, are in reality the same as his *Actinometra valida*.

Family ZYGOMETRIDÆ, *A. H. Clark.*

Genus ZYGOMETRA, *A. H. Clark.*

Zygometra, 1907, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 50, p. 347 (ANTEDON MICRODISCUS, Bell, 1884).

Differential Characters.—The species of the genus *Zygometra* have the elements of the I Br series united by what appears to be a perfect syzygy, though in reality it is a curious modification of a synarthry which has taken on all the characters of the syzygy. The II Br series, when present, are 4 (3 + 4). The Australian species have numerous arms, but the East Indian species have only from ten to thirty arms. The lower pinnules are enlarged and stout, but taper to a more or less flagellate tip. The cirri are long, with numerous segments of which the outer bear long dorsal spines.

Range.—Northern Australia to the Mergui Archipelago, Singapore, Hong Kong, and the Philippine Islands.

ZYGOMETRA MICRODISCUS (*Bell*).

Antedon microdiscus, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 163, pl. xv. (PORT MOLLE, 12 FMS.; *Nicol Bay, N. W. Australia*).—1888, P. H. Carpenter, "Challenger" Reports, Zool. vol. 26, p. 97, pl. xxxvii., figs. 4-6 (*Prince of Wales Channel, 8 fms.*).—1898, Döderlein, Denkschr. Ges. Jena, vol. viii., p. 476, pl. xxxvi., figs. 2, 2*a* (*Thursday Island*).

Zygometra microdiscus, 1909, A. H. Clark, Zool. Anzeiger, vol. 34, p. 367 (*Mermaid Strait, N. W. Australia*).

Differential Characters.—*Zygometra microdiscus* may be at once distinguished from all the other species of the genus by the almost or quite exclusive presence of division series of 4 (3 + 4), and the occurrence of at least four axillaries beyond that

of the I Br series. The enormously long lower pinnules and cirri, the latter reaching 40 mm.-45 mm. in the type, are characteristic features of this species. The proximal pinnules remind one very strongly of those of certain species of *Himerometra*, as for instance *H. bartschi*, and the arm structure not infrequently also approaches that characteristic of *Himerometra*, so that some care must be used in identification. The heavily plated disk and the presence of a pseudosyzygy between the elements of the I Br series are, however, ample to differentiate this species from any of the superficially similar forms among the Himerometridæ.

Australian Records.—Port Molle, Queensland, in 12 fathoms; Mermaid Strait, in the north-western part of Western Australia; Torres Strait, in 10 fathoms; Prince of Wales Channel, in 8 fathoms; Cape York; Thursday Island; Holothuria Bank; Lewis Island, Dampier Archipelago; Nicol Bay, North-western Australia.

Distribution.—This species is only known from the coasts of northern Australia.

Remarks.—In the type specimen the disk has been lost, and is just beginning to regenerate; this was mistaken for a normally small disk, the error being responsible for the specific name.

ZYGOMETRA MULTIRADIATA (*P. H. C.*).

? Hyponome sarsii, 1868, Lovén, Forhandl. Skand. Naturf. Christiania, vol. 10, p. liv. (Cape York).

Antedon multiradiata, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 96, pl. ix. (off Booby Island, Torres Strait, 6 fms.)

Differential Characters.—This species is essentially like the preceding, but it only has three axillaries above that of the I Br series, and the proximal pinnules are much less stout.

Australian Record.—This form was dredged by the "Challenger" in 10° 36′ S. lat., 14° 55′ E. long. (off Booby Island, Torres Strait), in 6 fathoms; in the British Museum I found some specimens from North-western Australia, and from Lewis Island in the Dampier Archipelago, as well as one collected by the "Alert" in Somerset Passage, near Albany Island, in 5-9 fathoms.

It is probably a detached visceral mass of this species which was described by Professor Sven Lovén as *Hyponome sarsii* from Cape York.

Range.—Northern Australia.

ZYGOMETRA ELEGANS (*Bell*).

Antedon elegans, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 162, pl. xiii., figs. B, Ba (PORT MOLLE; *Thursday Island*).

Antedon fluctuans, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 94, pl. viii. (8° 56′ S. LAT., 136° 05′ E. LONG.). —1898, Döderlein, Denkschr. Ges. Jena, vol. viii., p. 475, pl. xxxvi., fig. 1 (*Thursday Island*).

Zygometra elegans, 1909, A. H. Clark, Zool. Anzeiger, vol. 34, p. 367 (*Mermaid Strait, N. W. Australia*).

Differential Characters.—In *Zygometra elegans* the II Br series are 4 (3 + 4), but the succeeding division series are entirely or mostly 2; the occurrence of the III Br series is not confined to the inner branch from the II Br series[3].

Specimens in the Australian Museum Collection.—Mast Head Island—One specimen with about sixty arms each about 70 mm. long; slightly more division series of 4 (3 + 4) are present than usual. Lagoon, Mast Head Island—One specimen with forty arms; the single remaining entire cirrus has fifty-six segments. Port Denison—Two specimens; one is a fine example with sixty arms about 100 mm. long and cirri xix., 45-48, 35-40 mm. long; the II Br series are 4 (3 + 4), the remaining series 2 rarely, on the exterior of the rays, 4 (3 + 4); this specimen agrees with four others at hand from Mermaid Strait, North-western Australia, collected by the German ship "Gazelle"; the other specimen is considerably smaller with twenty-nine arms 65 mm. long, the II Br series being 4 (3 + 4) and the III Br series 2; the cirri are xx., 35-39. Port Molle—One small specimen with eighteen arms about 50 mm. long and cirri xviii., 22-24, together with arm fragments from a larger individual. Port Curtis—Three specimens; one has the centrodorsal large, thick-discoidal, with the

[3] In working over the magnificent collection of Comatulids made at Singapore by Mr. Svend Gad, I found that the common *Zygometra* occurring there and in the Mergui Archipelago is not the same as that called *elegans* by Bell though it had been united with that species by Carpenter. It is a twenty to thirty-armed form, and the III Br series, which are always 2, are only developed interiorly in 1, 2, 2, 1 order. I thought at the time that the name *fluctuans* covered this species, but I now find that *fluctuans* is in reality only small *elegans*, and that the name is not available for the Singapore species at all. I therefore propose that it be called *Zygometra comata*, sp. nov., reinstating a *nomen nudum* long ago applied to it in MS. by Carpenter. A satisfactory description of *Zygometra comata* will be found in Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 151 ("*Zygometra fluctuans*"); it occurs in the Mergui Archipelago, at Singapore, and among the Philippine Islands.

Small specimens of this species are readily distinguished from small specimens of *Z. elegans* by the regularity in the development of the III Br series, these in *comata* appearing only internally, two to each ray.

dorsal pole very slightly concave, 5 mm. in diameter; the cirri are xv., 50-53, 35 mm. to 38 mm. long; there are thirty-five arms 80 mm. long; the III Br series are 4 (3+4) exteriorly and 2 interiorly as in the genus *Himerometra*; another has the centrodorsal discoidal about 4 mm. in diameter at the dorsal pole, nearly flat; the cirri are xxxv., 46-48, 35 mm. to 40 mm. long; 4 (3 + 4) series are slightly more numerous than usual; the third example is small with twenty arms 60 mm. long (all the II Br series being present); the dorsal pole of the centrodorsal is flat, 2·5 mm. in diameter; the cirri are xxiii., 20-22, 13 mm. long.

Additional Australian Records.—Port Molle, in 12-20 fathoms; Thursday Island; Arafura Sea (8° 56′ S. lat., 136° 05′ E. long.), 49 fathoms; Torres Strait, in 10 fathoms; Prince of Wales Channel, in 7 fathoms; Mermaid Strait, North-western Australia; Baudin Island, in 8-15 fathoms.

Range.—Northern Coast of Australia from Mermaid Strait, eastward and southward to Port Curtis, Queensland.

Family HIMEROMETRIDÆ, *A. H. Clark.*

Genus CRASPEDOMETRA, *A. H. Clark.*

Craspedometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 8 (*Antedon acuticirra*, P. H. Carpenter, 1882).

Differential Characters.—*Craspedometra* in Australia is most easily identified by its cirri; these are very long, smooth dorsally, very stout basally, but tapering gradually to a sharp point. The arms are from twenty-five to forty or more in number, the II Br series being 4 (3 + 4) and the III Br series 2, developed irregularly.

Range.—East Africa (Madagascar to the Red Sea) to Australia, and thence northward to Hong Kong and the Philippine Islands.

CRASPEDOMETRA ACUTICIRRA (*P. H. C.*).

Antedon acuticirra, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 509 (UNKNOWN).

Antedon australis, 1882, P. H. Carpenter, *tom. cit.*, p. 510 (SYDNEY).

Antedon ludovici, 1882, P. H. Carpenter, *tom. cit.*, p. 510 (HONG KONG).

Antedon bipartipinna, 1882, P. H. Carpenter, *tom. cit.*, p. 512 (HONG KONG).

Craspedometra acuticirra, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 159 (*Sydney*).

Differential Characters.—The long cirri, which are very stout at the base but gradually taper to a point, distinguish this species at once from all other Comatulids. It has usually about thirty arms in the vicinity of 125-150 mm. in length; the cirri are about 45 mm. long.

Australian Record.—The Copenhagen Museum possesses a fine specimen of this species which was collected at Sydney, New South Wales, many years ago. Professor Lütken labelled it *Antedon australis*, but he never described it; Dr. Carpenter examined it during his visit to Copenhagen, and mentioned some of its characters in discussing the type specimen of *C. acuticirra*. More recently I have examined it and published a detailed description and figure.

Range.—*Craspedometra acuticirra* ranges from the Mergui Archipelago and the Andaman Islands to Hongkong, and southward to Sydney, New South Wales.

Genus AMPHIMETRA, *A. H. Clark.*

Amphimetra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 6 (COMATULA [ALECTO] MILBERTI, J. Müller, 1846).

Differential Characters.—The species of *Amphimetra* are remarkable for the excessive shortness of the outer brachials. The elements of the division series and the proximal brachials are more or less swollen. In the ten-armed species the lower pinnules are all subequal, but in the multibrachiate forms they are, some of them (though never the first), enlarged, with more or less delicate tips, and often bear in the distal part of each segment strong lateral processes, resembling those characteristic of *Oligometra serripinna*.

Range.—*Amphimetra* is found from south-eastern Africa to Australia, the Philippine Islands, and southern Japan; the ten armed species are found from Queensland to Singapore and the Philippine Islands.

AMPHIMETRA VARIIPINNA (*P. H. C.*).

Antedon variipinna, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 506 (CANTON, CHINA).—1888, "Challenger" Reports, Zool., vol. 26, p. 256 (*Prince of Wales Channel*, 8 *fms*).—1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*N. W. Australia*, 9-38 fms).

Antedon crenulata, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 507 (BORNEO).

Antedon decipiens, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 159, pl. xi., figs. B, B*a* (ARAFURA SEA, 32-36 FMS.).

Antedon irregularis, 1884, Bell, *tom. cit.*, p. 161, pl. xiii., figs. A, A*a-c* (PRINCE OF WALES CHANNEL; TORRES STRAIT).

Differential Characters.—*Amphimetra variipinna* is easily distinguished from all other Australian Comatulids; it always has more than ten arms, usually from fifteen to twenty, with short discoidal brachials distally; the division series and arm bases are rugged and tuberculous; the long lower pinnules have segments with the distal corners produced into broad rounded processes so that the outline of the pinnules is strongly serrate.

Specimen in the Australian Museum Collection.—Mast Head Island—One fine twenty-two armed specimen. Ten miles south-west of Mapoon, 10 fathoms—Three fine specimens; one has nineteen arms 150 mm. long and cirri xvi., 41-43, 25 mm. to 30 mm. long; another has twenty-one arms 150 mm. long and cirri 30 mm. long with 40-42 segments; the third has seventeen arms 130 mm. long and cirri xxiii., 41-44, 30 mm. long. In these specimens the processes on the segments of the lower pinnules are strongly developed and typical; the cirri are more or less carinate distally, and the synarthrial tubercles are prominent so that the animals are characteristically rugose. Port Curtis—Two specimens; one has fourteen arms 80 mm. long and cirri xxiii., 35-40, 30 mm. long; the other has twenty-six arms 100 mm. long and cirri xxix., 35-45 (usually 40-41) 30 mm long; the centrodorsal is 5 mm. in diameter at the dorsal pole; the arm bases are exceptionally rugged with the synarthrial tubercles large, prominent, and bluntly conical; the lower brachials are very short but much swollen with strongly projecting distal edges; the division series are just in opposition laterally; the distal cirrus segments are very strongly and sharply carinate, this carination standing out as a broad spine of which the outer edge is almost or quite parallel to the longitudinal axes of the segments.

Additional Australian Records.—Prince of Wales Channel, in 7 fathoms, in 8 fathoms, and in 7-9 fathoms; Torres Strait, in 5-7 fathoms, and in 10 fathoms; Holothuria Bank, in 24, and in 38 fathoms; North-east of Holothuria Bank, in 15-20 fathoms; Dundas Strait, in 17 fathoms; Baudin Island.

Distribution.—Mergui Archipelago, Singapore, Canton, and the Philippine Islands southward to Australia, reaching, on the east coast, Port Curtis, Queensland.[4]

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[4] Mr. H. C. Chadwick has recorded this species from Ceylon, but such of his specimens as I have examined prove to be *Heterometra reynaudii*.

AMPHIMETRA DISCOIDEA (*A. H. Clark*).

Comatula dibrachiata, 1862, Dujardin and Hupe, Hist. nat. des zoophytes, Echinoderms, p. 208 (*nomen nudum*).

Antedon milberti, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 156 (*Port Molle ; Port Denison ; Prince of Wales Channel ; Torres Strait*).—1885, Proc. Linn. Soc. N.S. Wales., vol. 9 (1884), p. 497 (*Port Denison ; Port Molle*).—1894, Proc. Zool. Soc., 1894, p. 394 (*N. W. Australia*, 8-15 *fms.*).

Himerometra discoidea, 1908, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 52, part 2, p. 215 (PORT DENISON).

Amphimetra formosa, 1909, A. H. Clark, Proc. U.S. Nat. Mus., vol. 37, p. 32 (*Philippines ; nomen nudum*).—Vidensk. Medd. fra den Naturhist. Forening i Köbenhavn, 1909, p. 157 (SINGAPORE ; PHILIPPINES).

Differential Characters.—So far as known this species never has more than ten arms ; the lower pinnules are subequal in length, and all rather short ; the cirri are slender, the segments, at least in the proximal half, being somewhat longer than broad. *A. milberti*, which also occurs in Australia, has very stout cirri with all the segments much broader than long and subequal.

Specimens in the Australian Museum Collection.—Port Denison —Twelve specimens ; one of these has cirri xxii., 46, 30 mm. long ; another xx., 36-49, 30 mm. long ; a third xxiii., 43, 40 mm. long, a fourth xxii., 42-45, 30 mm. long ; these and five other similar examples exactly resemble the type, which also came from Port Denison ; there is no tendency toward the curiously abrupt type of synarthrial tubercle nor the short segmented proximal pinnules characteristic of the form which I have called *formosa*, from Singapore and the Philippine Islands ; three other large and well developed specimens with cirri about xx., 46-51 (maximum) 30 mm. to 37 mm. long, however, exhibit the synarthrial tubercles and lower pinnules of the type found in *A. formosa* more or less perfected, and I therefore find myself obliged to consider the two supposed species as only a single form, "*formosa*," representing merely a more developed stage than typical *discoidea*. Port Molle—Two specimens with cirri about xx., 39-42, 30 mm. long ; both of these have synarthrial tubercles resembling those of the type of *A. formosa*.

Additional Australian Records.—Torres Strait, in 10 fathoms ; Prince of Wales Channel, in 7-9 fathoms ; Holothuria Bank, in 15 fathoms ; Port Molle, in 12-20 fathoms ; Port Denison, in 3 fathoms ; North-western Australia, in 8-15 fathoms ; West Australia.

Range.—Singapore and the Philippine Islands southward to Australia, reaching Port Molle on the eastern coast.

There is a specimen of *Amphimetra discoidea* in the Paris Museum labelled by P. H. Carpenter "*Comatula* (*Antedon*) *milberti*, var. *dibrachiata*, which closely resembles the type in the United States National Museum; it has 26 or 27 cirrus segments. It appears to have been the specimen from which the drawing of "*Comatula carinata*" in Guérin-Ménéville's "Iconographie du regne animal" (Plate 1, fig. 2*a*) was made.

AMPHIMETRA MILBERTI (*J. Müller*).

Comatula (*Alecto*) *milberti*, 1846, J. Müller, Monatsber. preuss. Akad., 1846, p. 178 ("North America").

Comatula jacquinoti, 1846, J. Müller, *loc. cit.* (Ceram).

Comatula laevissima (part), 1875, Grube, Jahresber. d. schles. Ges. für vaterl. Cultur, 1875, p. 74 (North Borneo).

Antedon milberti (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 156 (*Port Molle*).

Amphimetra milberti, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 7.

Differential Characters.—This species is easily distinguished from the preceding by its very stout cirri, all of the segments in which are twice as broad as long.

Australian Record.—The "Alert" obtained a single specimen of this species at Port Molle; all the other specimens listed in the "Alert" Report from Port Molle belong to the preceding form.

Range.—Mergui Archipelago to Borneo and the Philippine Islands, and south to northern Australia.

Genus HETEROMETRA, *A. H. Clark.*

Heterometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 11 (Antedon quinduplicava, P. H. Carpenter, 1888).

Differential Characters.—The II Br series of *Heterometra* are 4 (3 + 4) and the succeeding division series, which are irregularly developed, are 2. In general the arm number is from fifteen to thirty. The proximal pinnules, usually excepting P_1, are enlarged, but are always slender and flagellate distally; the outer brachials are distinctly wedge-shaped and of moderate length.

Range.—*Heterometra* is found from East Africa eastward to northern Australia and the Philippine Islands.

HETEROMETRA NEMATODON (*Hartlaub*).

Antedon milberti (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 156 (*Port Molle*).

Antedon nematodon, 1890, Hartlaub, Nachr. Ges. Göttingen, Mai, 1890, p. 185 (Bowen).—1891, Nova Acta Acad., vol. 58, No. 1, p. 27, pl. i., fig. 9 (*Bowen*).

Differential Characters.—This is easily distinguished from the only other Australian species of the genus by its numerous arms (thirty-eight) and cirrus segments (40-50); the arms are over 80 mm. long.

Australian Records.—The type specimen of this species was obtained many years ago by the Godeffroy Company, and received the MS. name of *nematodon* from Professor Lütken while in the Godeffroy Museum. It was found at Bowen, Queensland; a second smaller specimen was obtained by the "Alert" at Port Molle.

HETEROMETRA BENGALENSIS (*Hartlaub*).

Antedon bengalensis, 1890, Hartlaub, Nachr. Ges. Göttingen, Mai, 1890, p. 182 (Bay of Bengal).—1891, Nova Acta Acad., vol. 58, No. 1, p. 19, pl. i., fig. 2, pl. ii., fig. 16 (*Bay of Bengal*).

Antedon anceps, 1904, Chadwick, Rep. Ceylon Pearl Oyster Fisheries, Part II, Supplementary Report, xi., p. 157.

Heterometra bengalensis, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 11.

Differential Characters.—*Heterometra bengalensis* is readily distinguished from *H. nematodon*, the only other Australian species, by its short cirri with few (14-24) segments, the outer with long spines, and by the small number (eleven or twelve) of its arms.

Specimens in the Australian Museum Collection.—Port Curtis —Three small specimens, one with twelve and two with eleven arms 25 mm. to 33 mm. long; the cirri of the largest are xv, 14-18 (usually 15); except for the characters incident to immaturity, these specimens agree well with numerous others at hand from India. A specimen in the British Museum was taken on Holothuria Bank, in 15 fathoms. There are no previous Australian records.

Range.—Ceylon to the Philippine Islands, and southward to Australia, reaching, on the east coast, Port Curtis.

Family STEPHANOMETRIDÆ, *A. H Clark.*

Genus STEPHANOMETRA, *A. H. Clark.*

Stephanometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 9 (ANTEDON MONACANTHA, Hartlaub, 1890).

Differential Characters.—In the genus *Stephanometra* the pinnules of one or more of the lower pinnule pairs are enlarged, with less than eighteen segments, greatly stiffened, and very sharply pointed, becoming spine-like in character. The division series are all 2, each of their component ossicles with a rounded ventro-lateral process supporting the visceral mass.

Range.—*Stephanometra* ranges from Mauritius and the Red Sea to northern Australia, Fiji, Tonga, and the Philippine Islands.

It is represented in the Caribbean Sea by *Analcidometra.*

STEPHANOMETRA MONACANTHA (*Hartlaub*).

Antedon monacantha, 1890, Hartlaub, Nachr. Ges. Göttingen, Mai, 1890, p. 179 (MORTLOCK ISLAND; TORRES STRAIT).—1891, Nova Acta Acad., vol. 58, No. 1, p. 59, pl. 3, figs. 33, 38 (*Mortlock Island; Torres Strait*).

Differential Characters.—*Stephanometra monacantha* usually has from twenty to thirty arms; the cirri are without dorsal spines, and the second pinnule, in abrupt contrast to the others, is much enlarged, stiff and spine-like, with 12-14 (rarely as many as 20) segments, of which the outer are very long.

Australian Record.—This form was recorded at the time of its description from Torres Strait.

Distribution.—This well marked species occurs from the Nicobar Islands and Singapore to the Philippines, the Carolines, and the Tonga Islands, and on the northern coast of Australia.

Family MARIAMETRIDÆ, *A. H. Clark.*

Genus DICHROMETRA, *A. H. Clark.*

Dichrometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 12 (*Alecto flagellata*, J. Müller, 1841).

Differential Characters.—The proximal pinnules of *Dichrometra*, though enlarged, are slender and flagellate distally and are composed of more than twenty-four segments; the division series are all 2, and are in lateral apposition, sometimes being considerably flattened against each other.

Range.—*Dichrometra* is found from East Africa eastward to Fiji, Tonga, the Marshall Islands, and the Philippines, and from northern Australia to southern Japan.

DICHROMETRA ARTICULATA (*J. Müller*).

Comatula (*Alecto*) *articulata*, 1849, J. Müller, Abhandl. k. preuss. Akad., 1847, p. 263 (MOLUCCAS).

Antedon articulata, 1884, Bell, Rep Zool. Coll. H.M.S. "Alert," p. 160 (*Port Molle*).—1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 379.

Dichrometra articulata, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 13.

Differential Characters.—This species is readily distinguished from the other Australian species of the genus by having P_2 and P_3 slender and flagellate, about equal in length, and by having cirri with more than thirty-five segments, of which the outer bear prominent spines.

Dichrometra articulata was originally described from the Moluccas, and has since been recorded by Bell from Port Molle, Queensland, where it was dredged by the "Alert" in 12-20 fathoms.

DICHROMETRA REGINÆ (*Bell*).

Antedon reginæ, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 160, pl. xii., figs. A, A*a* (PORT MOLLE).

Dichrometra reginæ, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 13.

Differential Characters.—This species has cirri with about thirty segments, of which the outer are strongly carinate dorsally; P_2 is not greatly larger than P_3. It is not clear from the original description just how it differs from *D. gyges* nor how either of them differ from *D. tenera* or *D. protectus* A redescription of this species with adequate figures is much to be desired.

Dichrometra reginæ is only known from a single specimen which was collected by the "Alert" at Port Molle, Queensland, in 12-20 fathoms.

Remarks.—The type and only known specimen of this species, which I examined in London, has the cirri xxv, 29-34; the longest cirrus segment is about as long as broad; the distal segments are about one-third broader than long; dorsal spines are developed from the thirteenth or fifteenth segment onward; as a whole the cirri are moderately stout, but not especially long.

There are thirty-eight arms about 100 mm. long.

P_2 is about 22 mm. long, very slender and delicate, flagellate, soft, with forty-three segments which are only slightly longer than broad; P_3 is similar to P_2, but the following pinnules are shorter; P_1 is 14 mm. and P_4 10 mm. in length; there is but a slight difference in basal stoutness between the earlier pinnules, but P_2 and P_3 taper much less rapidly than the others.

This species is very close to *D. articulata*, and further investigation may show that the two are really identical.

DICHROMETRA GYGES (*Bell*).

Antedon gyges, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 160, pl. xii., figs. B, B*a*, *b* (THURSDAY ISLAND).

Dichrometra gyges, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 13.

Differential Characters.—*Dichrometra gyges* has P_2 not much longer than P_1; the cirri resemble those of *D. reginæ*, but have a slightly greater number of segments. There is a possibility that it is the same thing as the species known as *Dichrometra tenera*. Like *D. reginæ* this species is badly in need of redescription.

The only known specimen of *Dichrometra gyges* was collected by the "Alert" at Thursday Island, in 3-4 fathoms.

Remarks.—In the type of this species, which I examined at London, the cirri are xxxv, 24-29 (usually 28), 20 mm. to 25 mm. long; from the eleventh onward the segments are strongly carinate, or are supplied with broadly rounded dorsal spines.

There are forty-one (thirty-seven, plus four lacking) arms 80 mm. long.

P_2 is the longest, but is slender, resembling P_1; P_3 is slender and weak, not nearly so large as P_1; the basal segments of the earlier pinnules are more or less carinate.

This species is nearly related to *D. tenera*, of which it may eventually prove to be a synonym.

DICHROMETRA TENERA (*Hartlaub*).

Antedon tener, 1877, Lütken, Mus. Godeffr. Cat., vol. 5, p. 100.

Antedon tenera, 1890, Hartlaub, Nachr. Ges. Göttingen, Mai, 1890, p. 180 (QUEENSLAND; TORRES STRAIT).—1891, Nova Acta Acad., German, vol. 58, No. 1, p. 66 (*Queensland*; *Port Denison*; *Torres Strait*).

Dichrometra tenera, 1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Foren. i Köbenhavn, 1909, p. 173 (*Bowen*).

Differential Characters.—This species is readily distinguished from *D. articulata* by its fewer cirrus segments which are strongly carinate instead of spiny distally, by having P_2 considerably longer than P_3, and the proximal pinnules on the outer side of the outer arms of each post-radial series markedly larger than those on the inner side of the outer arms or on the inner arms.

Australian Records.—Torres Strait; Queensland; Bowen and Port Denison, Queensland. There is a dry specimen in the British Museum (labelled *Antedon articulata*) from Port Essington, Queensland, and there is a specimen in the Paris Museum from Thursday Island.

Distribution.—Marshall Islands to northern Australia, south on the east coast to Port Denison, Queensland.

Family COLOBOMETRIDÆ, *A. H. Clark.*

Genus CENOMETRA, *A. H. Clark.*

Cenometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 8 (HIMEROMETRA UNICORNIS, *A. H. Clark*, 1908).

Differential Characters.—The cirri of the species of *Cenometra* are composed of very short subequal segments, of which those in the outer portion bear two dorsal tubercles or spines each, placed side by side: P_2 is greatly enlarged, abruptly larger than any of the other pinnules, and is strongly curved outward in the direction of the arm tip.

Range.—Mauritius and Ceylon to northern Australia, thence northward to the Philippine Islands and the Gulf of Tonkin.

CENOMETRA CORNUTA, *sp. nov.*

Antedon, sp. (near *macronema*), 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*North-west Australia*).

Description.—Cirri XIV, 35-37, about 20 mm. long; the cirri are rather slender, and are composed of short segments, none of which are less than twice as broad as long; the proximal segments are flattened dorsally; in the outer half of the cirri the segments bear dorsally a pair of tubercles with their apices well separated.

There are, in the type, twenty-six arms about 110 mm. long; the lateral processes on the division series are broad with truncated or roundedly incised outer margins.

P_2 is very stout and very strongly curved, with 11-14 (usually 12) segments, most of which are about as long as broad; on the distal side the distal ends of the segments are strongly everted and serrate; this eversion is well marked even on the second

segment; the first, second, and third segments of the earlier pinnules are slightly carinate, the carination being sharply truncated distally so that the outer profile is straight and not convex as in *C. emendatrix*.

The colour is white and purple, in bands of about one quarter of an inch in width; the cirri are brown.

Localities.—Adele Island, North Australia (type locality); Baudin Island.

The type specimen is in the British Museum.

Genus COLOBOMETRA, *A. H. Clark*.

Colobometra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 5 (ANTEDON PERSPINOSA, P. H. Carpenter, 1881).

Differential Characters.—The genus *Colobometra* lacks the first inner pinnule (P_a). All of the species have ten arms, the brachials with exceedingly spiny distal ends. The cirri are long with numerous segments, the outer bearing paired dorsal spines, the proximal with produced and very spinous edges. Some or all of the lower pinnules are much enlarged and their component segments have very stiff with very spinous distal ends; the middle and outer pinnules also have segments with very spinous distal ends.

Range.—*Colobometra* is found from the Red Sea eastward to northern and eastern Australia, Lord Howe Island, the Solomon Islands, the Philippines, and Singapore.

COLOBOMETRA PERSPINOSA (*P. H. C.*).

Antedon perspinosa, 1881, P. H. Carpenter, Notes from the Leyden Museum, vol. 3, p. 178 (JOBIE).

Antedon insignis, 1882, Bell, Proc. Zool. Soc., 1882, p. 534 (PORT DENISON).

Antedon loveni, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 158, pl. x., figs. B, C*a-e* (not A*a-e* as given in the reference to the plate) (PORT DENISON; this and the preceding species are founded on the same specimen).

Colobometra perspinosa, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 6.

Differential Characters.—*Colobometra perspinosa* lacks the first inner pinnule (that on the first syzygial pair) on each arm; the long cirri have about sixty segments, comparatively long proximally, short distally, the longer proximal segments with the distal ends produced into an overlapping border of long spines; the shorter distal segments bear paired spines dorsally; the lower

pinnules, except P_1, are very long and greatly stiffened, with long spines about the distal ends of each segment; the outer pinnules have spinous segments, and the brachials are bordered distally with long spines.

Specimens in the Australian Museum Collection.—Port Jackson —A small arm fragment. Lord Howe Island—One specimen, without cirri; the very stiff lower pinnules reach a length of 23 mm. (P_2); the arms were probably about 120 mm. long; there were xviii. cirri arranged in one and a partial second irregular marginal row; the dorsal pole of the centrodorsal is deeply concave; the synarthrial tubercles are but slightly marked; in the proximal portion of the arms there is a faint low rounded median carination; P_1, which is not stiffened like the succeeding, is only half as long as P_2.

Additional Australian Record.—Port Denison, Queensland., in 3-4 fathoms.

Range.—*Colobometra perspinosa* is known from Port Jackson and Port Denison, Australia, from Lord Howe Island, and from the Island of Jobie in Geelvink Bay, New Guinea.

Genus DECAMETRA, *A. H. Clark.*

Decametra, 1910, A. H. Clark, Proc. U. S. Nat. Mus., vol. 40, p. 31 (DECAMETRA MOBIUSI, *sp. nov.*).

Differential Characters.—The species of the genus *Decametra* have ten arms and lack the first inner pinnule (P*a*) like those of *Colobometra*; but only P_2 is enlarged, and that is not greatly different from the following pinnules; its component segments are not especially long, and their distal ends are but slightly when at all prominent, and the pinnule is slender and flagellate distally. The cirri are short, and are composed of subequal segments (instead of long proximal and short distal segments as in *Colobometra*), the outer bearing a more or less denticulate transverse ridge, or sometimes a pair of small tubercles.

Range.—*Decametra* occurs from South-eastern Africa and Mauritius to Ceylon and North-western Australia, Singapore, and the Philippine Islands.

DECAMETRA STUDERI (*A. H. Clark*).

Oligometra studeri, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 41 (DIRK HARTOG ISLAND, 7 FMS.).

Cyllometra studeri, 1909, A. H. Clark, *tom. cit.*, p. 88.—Zool. Anzeiger, vol. 34, p. 368.

Differential Characters.—*Cyllometra studeri* is most closely related to *C. informis*, which was dredged by the "Challenger" among the Philippine Islands. It differs from that species most obviously in its smooth pinnules, the lower and middle pinnules in the latter having slightly overlapping and spinous ends to the segments, and in the much greater length and slenderness of P_2 which is twice as long as P_3 with eighteen segments most of which are elongated, instead of only slightly when at all longer than P_3, with twelve segments, most of which are squarish. Both species are readily distinguished from all the others of the genus by the small number of cirrus segments.

Australian Record.—The type and only known specimen of this species was collected by the naturalists of the German steamer "Gazelle," at Turtle Bay Anchorage, Dirk Hartog Island, in 7 fathoms.

Genus OLIGOMETRA, *A. H. Clark.*

Oligometra, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 216 (ANTEDON SERRIPINNA, P. H. Carpenter, 1881).

Differential Characters.—The species of *Oligometra* are all small; they possess ten arms as in *Decametra*, but the first inner pinnule (P*a*) is always present. The cirri are short, rarely with more than twenty-five segments almost all of which are about as long as broad and bear across the middle of the dorsal side a serrate transverse ridge which appears as a small median spine in lateral view; the opposing spine is small, but prominent, median and erect. One or more of the lower pinnules (usually P_1 or P_2) is enlarged, and its segments may bear lateral processes.

Range.—*Oligometra* occurs from South-eastern Africa to Ceylon and northern and eastern Australia, the Tonga Islands and the Philippines, and northward to Japan.

OLIGOMETRA CARPENTERI (*Bell*).

Antedon carpenteri, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 157, pl. x., figs. A*a-c* (PORT CURTIS).

Antedon milberti (part), 1894, Bell, Proc. Zool. Soc., 1894, p. 394 (*North-western Australia*).

Antedon serripinna, 1894, Bell, *loc. cit.*

Oligometra carpenteri, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 126.

Differential Characters.—This is a slender and delicate little species, much resembling *O. serripinna;* P_1 is small, and P_2 greatly enlarged with long lateral processes on the segments.

Specimens in the Australian Museum Collection.—Port Curtis, Queensland—Three specimens.

Additional Australian Records.—Port Curtis, in 7 fathoms, and in 11 fathoms; Prince of Wales Channel, in 7-9 fathoms; Bassett-Smith Bank, in 9 fathoms; Holothuria Bank, in 39 fathoms; Baudin Island, in 8-15 fathoms.

OLIGOMETRA ADEONÆ (*Lamarck*).

Comatula adeonæ, 1816, Lamarck, Hist. Nat. des animaux sans vertèbres, vol. 2, p. 535 (AUSTRALIA).

Antedon adeonæ (part), 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert, p. 156 (*Port Curtis; Port Denison*).

Antedon pinniformis, 1884, Bell, *loc. cit.* (*Dundas Strait*).

Antedon bidens, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 158, pl. xi., figs. A*a-c* (TORRES STRAIT).—1898, Döderlein, Denkschr. Ges. Jena, vol. 8, p. 476, pl. 36, figs 3-3*d* (*Thursday Island*).

Oligometra bidens, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 126.—1909, A. H. Clark, Zool. Anzeiger, vol. 34, p. 368 (*N. W. Australia*).

Oligometra adeonæ, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 126.

Differential Characters.—This species is related to *O. thetidis*, and these two are easily distinguished from the other Australian species of the genus by the large size of P_1 and the comparatively small size and smoothness of P_2, as well as by their stout, robust build. The cirrus segments of *O. bidens* bear dorsally double transverse ridges instead of a single transverse ridge as in *O. thetidis*, and are more numerous; the genital pinnules of *O. bidens* do not appear to be expanded laterally as in *O. thetidis*.

Australian Records.—"Australia"; Torres Strait, in 10 fathoms; Thursday Island; Port Curtis; Port Denison; Dundas Strait: Baudin Island, in 8-15 fathoms; North-western Australia.

Remarks.—At Paris I examined the types of this species, which were obtained in Australia by MM. Péron and Le Sueur in 1803; the cirri are about xxx, 17-20 (most commonly 19), very stout; the first segment is very short, the following gradually increasing in length and becoming nearly as long as broad on the sixth and following; the fourth and following have on the dorsal surface two transverse ridges which appear as two small spines in lateral view

The rays and first three brachials resemble those of the species of *Tropiometra* in being very broad and sharply flattened against

their neighbours laterally ; there is considerably more flattening than in the species of *Tropiometra*, as the plates are deeper dorso-ventrally ; the four brachials following the first syzygial pair are oblong and very short ; the following are triangular, soon becoming about as long as broad.

The proximal pinnules are large and strongly prismatic ; P_1 is the largest and longest, and is composed of from eight to ten segments, of which the third and fourth are the largest and longest ; the size, stoutness, and length of the pinnules gradually decreases to P_5 or P_6 ; the distal pinnules are not much longer than P_6.

Bell's *Antedon bidens* is the same thing as Lamarck's *Comatula adeonæ* ; in the best specimen obtained by the "Alert" the cirri are about xx, 21 ; the bidentate appearance is caused by the moving back of the transverse ridge so far that it is near the proximal end of the segments, while the distal dorsal edge of the segments has become prominent, so that there are in effect two transverse ridges, appearing as two small spines in lateral view.

P_1 is the longest, considerably stiffened ; P_2 is similar, but slightly shorter ; P_3 is similar, but slightly shorter than P_2 ; the distal ends of the segments of these lower pinnules tend to become slightly prominent.

The figure of this species given in the "Alert" Report is very misleading, but a good (photographic) illustration of it is given by Döderlein in the reference cited.

OLIGOMETRA THETIDIS (*H. L. Clark*).

Oligometra thetidis, 1909, H. L. Clark, Mem. Aust. Mus., vol. 4, Part 11, p. 522, pl. xlvii., figs. 1-3 (OFF WOLLONGONG, 55-56 FMS.).

Description.—I happened to be in Cambridge, Massachusetts, when Dr. H. L. Clark received the collection of Echinoderms brought together by H.M.C.S. "Thetis," and he most courteously permitted me to examine the specimens of Crinoids therein contained. This new *Oligometra* is a form of rather exceptional interest, and I availed myself of the opportunity of drawing up a careful description of it. This description is somewhat more detailed than that published by Dr. Clark, and follows more closely the terminology and form in present use, so that it may not be out of place to incorporate it here.

Centrodorsal low-hemispherical, a rather large polar area bare, the cirrus sockets arranged in two irregular closely crowded rows.

Cirri xv-xx, 15 (rarely 14, 16, or 17), short and stout ; first segment very short, second somewhat longer, becoming on the

fourth and following about as long as broad ; fourth and following segments with a median transverse dorsal ridge, appearing like a small spine in lateral view ; at first the apex of this ridge is practically a straight line, but later it becomes gradually more and more convex and at the same time narrower, so that on the terminal segments it resolves itself into a laterally elongated centrally arched tubercle ; opposing spine short but prominent ; median, erect, equal in height to about one-fourth the lateral diameter of the penultimate segment ; terminal claw slightly shorter than the penultimate segment, stout and rather abruptly curved proximally, becoming slender and nearly straight distally.

Radials plainly visible, between two and three times as broad as long ; IBr_1 trapezoidal, about twice as broad as long, basally in lateral apposition, gradually separating distally ; IBr_2 broadly pentagonal, about one and one-half times as broad as long.

Ten arms about 25 mm. long ; first brachial wedge-shaped, interiorly united for almost its entire length ; second brachial similar, but proportionately longer ; third and fourth brachials (syzygial pair) about as long as broad, oblong ; following brachials to the eighth oblong, about twice as broad as long, then becoming triangular and about as long as broad, and wedge-shaped and longer than broad distally ; synarthrial tubercles more or less, but never strongly, developed.

Syzygies occur between the third and fourth and seventh and eighth brachials, thence at intervals of from three to five (usually four) oblique muscular articulations.

P_1 comparatively long and stout, tapering uniformly from the base to the tip, with twelve segments, the first about as long as broad, the second half again as long as broad, the third and following about twice as long as broad (slightly more proximally, slightly less distally) ; P_2 similar, but considerably shorter with eight segments, the first squarish or not quite so long as broad, the second about half again as long as broad ; the remainder about twice as long as broad ; P_3 shorter than P_2 with about twelve segments, the first not so long as broad, the second to the fifth about as long as broad and rather stout, the remainder longer than broad ; P_4 similar, but the third and fourth segments are slightly broader ; following pinnules with the third and fourth segments laterally expanded forming a roof over the genital glands ; the fifth segment is expanded proximally but tapers distally, and the remaining segments are slender. This swollen and expanded condition of the pinnule segments persists practically unchanged to P_{15}, at which point the arms of the specimens examined are all broken off.

The colour (in spirits) is yellowish-white, transversely banded on each segment with purple, rarely entirely yellowish-white or entirely purple.

The preceding description was drawn up from an examination of nineteen specimens, all from the type locality.

Differential Characters.—The only species with which this needs comparison is *O. adeonæ*, with which it agrees in the general stoutness of its build and in the larger size of P_1 over P_2. It is smaller and has fewer cirrus segments than that species, however, and they lack the curious bidentate structure dorsally; as a whole, also, the cirri are considerably stouter than those of *O. adeonæ*. There is no swelling of the genital pinnules in *O. adeonæ*.

There can be no confusion between these two forms and *O. carpenteri* and *O. serripinna*, as the latter are slender and delicate creatures with a small and delicate P_1 and much enlarged and stiffened P_2, the latter having stout lateral processes on its segments.

Specimens Examined.—Off Wollongong, 55-56 fathoms—Nineteen specimens.

These are the original specimens upon which the species was founded.

Remarks.—I cannot see any grounds for believing that this form may eventually turn out to be Lamarck's *adeonæ* as suggested by Dr. Clark; it is much smaller than that species, and the pinnules could not possibly be described as long, nor are the three or four first the longest. In general appearance it is curiously similar to *Analcidometra caribbea*[5] from the Carribean Sea; it is about the same size, the lower pinnules are more or less similar in shape and proportions, and the genital pinnules are similarly expanded.

Family TROPIOMETRIDÆ, *A. H. Clark.*

Genus TROPIOMETRA, *A. H. Clark.*

Tropiometra, 1907, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 50, p. 349 (COMATULA CARINATA, Lamarck, 1816).

Differential Characters.—In the genus *Tropiometra* the I Br series and the first two brachials are large and broad, in lateral apposition, and somewhat flattened laterally, but the remaining brachials are exceedingly short; the dorsal surface of the arm may be smooth, or there may be a tubercle developed in the middle of the dorsal side of each brachial, which sometimes rises into a very high carination. The cirri are stout with from

[5] *Oligometra caribbea*, 1908, A. H. Clark, Proc. U.S. Nat. Mus., vol. 34, No. 1608, p. 238.

twenty to forty subequal segments, and perfectly smooth dorsally. The ambulacra are without ambulacral plating. The centrodorsal is discoidal, thick and broad. The pinnules are long and moderately stout in the earlier part of the arm, where they tend to be prismatic, but become shorter and more slender distally; the proximal pinnules are not essentially different from those following.

Range.—Carribean Sea to southern Brazil; St. Helena; West Africa; Cape Colony to Suez, and eastward to Australia, the South Sea Islands, and southern Japan.

TROPIOMETRA AFRA (*Hartlaub*).

Antedon afra, 1890, Hartlaub, Nachr. Ges. Göttingen, Mai, 1890, p. 172 (BOWEN).

Tropiometra afra, 1908, A. H. Clark, Proc. U.S. Nat. Mus., vol. 36, p. 315 (*Misaki, Japan*; *South Pacific*).—1909, A. H. Clark, Vidensk. Medd. fra den Naturhist. Forening i København, 1909, p. 184 (*Bowen*; *Korean Straits*).

Differential Characters.—This is a large and stout species with arms usually somewhat over 200 mm. long, which are rounded and perfectly smooth dorsally, and stout cirri with usually from 30-35 or more segments. So far as known the colour is always either entirely yellow or entirely violet, never mottled.

Australian Records.—Bowen; I have also examined a specimen labeled "South Pacific" which probably came from Australia. Only three Australian specimens are known, two having come from Bowen.

Distribution.—From Queensland this species ranges northward to southern Japan where it is common in the Korean Straits and abundant at Misaki.

TROPIOMETRA ENCRINUS, *A. H. Clark.*

Tropiometra encrinus, 1911, A. H. Clark, Proc. U.S. Nat. Mus., vol. 40, p. 36 (EAST INDIES).

Differential Characters.—This is a smaller form than the preceding, the arms being rarely more than 120 mm. in length; each brachial after those just at the base of the arms bears a pronounced median tubercle or keel in its distal portion; the cirri have between twenty and twenty-five segments. The colour is mottled yellow and purple.

Australian Records.—There are no definite Australian records, but I have examined a number of specimes labeled "South Pacific" which possibly came from there. The species occurs at Norfolk Island, and apparently in the Marshall Group.

Family THALASSOMETRIDÆ, *A. H. Clark.*

Genus PTILOMETRA, *A. H. Clark.*

Ptilometra, 1907, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 50, p. 358 (COMATULA MACRONEMA, J. Müller, 1846).

Differential Characters.—The pinnules of *Ptilometra* are strongly pismatic, stiffened, and all are approximately similar; P_1 is smaller than the succeeding pinnules; at the arm tip the pinnules decrease in length very abruptly and the very short crescentic brachials curve inward between the outermost pinnules, so that the arm tip at first sight always appears to be broken off. The arms are stout and dorsally rounded basally, becoming laterally flattened and strongly carinate distally, each brachial with a long overlapping spine; the division series are always 2, and the lower part of the animal is compressed so that the division series and arm bases are flattened against each other; the cirri are stout basally, but taper distally; they are exceedingly long, and may be longer than the arms though usually they are about three-fourths of the arm length. The arms are from twelve to thirty in number in fully grown individuals. The centrodorsal is large and more or less columnar, and the cirrus sockets are closely crowded and more or less irregularly arranged.

This genus is nearly related to *Pterometra* of the East Indies, but in that genus the cirrus sockets are arranged in ten columns on a more or less conical centrodorsal, and the proximal cirrus segments bear long slender ventral overlapping spines.

Range.—Southern Australia, north to Dirk Hartog Island on the west and Port Stephens on the east.

PTILOMETRA MACRONEMA (*J. Müller*).

Comatula macronema, 1846, J. Müller, Monatsber. k. preuss. Akad., 1846, p. 179 (KING GEORGE SOUND).

?*Antedon wilsoni*, 1888, Bell, Ann. Mag. Nat. Hist. [6], vol. 2 pp. 402, 403 (PORT PHILLIP).—1890, P. H. Carpenter, Proc. Roy. Soc. Vict. (N.S.), vol. 2, p. 135 (*Port Phillip*).

Antedon macronema, 1889, Studer, Die Forschungsreise S.M.S. "Gazelle," iii. Thiel, p. 185 (*Dirk Hartog Island*).

Ptilometra dorcadis, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 39 (DIRK HARTOG ISLAND, 7 FMS.).

Ptilometra macronema, 1907, A. H. Clark, Smiths. Miscell. Coll. (Quarterly Issue), vol. 50, p. 358.

Differential Characters —In its general appearance this species is more robust than *P. mulleri* from New South Wales; the centrodorsal is thicker and more columnar, the cirri are longer and stouter, and therefore not so slender distally, while in the basal portion of the fully developed cirri the segments are as long as or slightly longer than broad instead of, as in *mülleri*, about twice as broad as long; the proximal pinnules are more enlarged and longer than in *mulleri*, with considerably longer segments of which the central are half again to twice as long as broad instead of not so long as broad as in *P. mulleri*; in the middle pinnules of *mülleri* the segments do not become longer than broad until the distal quarter is reached, while in the present species the third and following are always longer than broad, and the distal are considerably elongated. In *macronema* there is a strong tendency for the cirrus sockets to be arranged in columns, about four in each radial area, a tendency seldom indicated in *mülleri*.

Specimens in the Australian Museum Collection.—Kangaroo Island, South Australia—Two fine specimens; one has thirty-two arms 55 mm. to 60 mm. long, and cirri about l. 82-88, 65 mm. long; the centrodorsal is 6 mm. high and 8 mm. in diameter; the III Br series are developed externally in 2, 1, 1, 2 order as is always the case in this group; the lower pinnules are large and long.

The other is six-rayed with twenty-six arms, five, four, three, four, six, and four to a post-radial series; the cirri are about l.; the centrodorsal is 5 mm. high and 8 mm. in diameter.

In both of the specimens most of the cirri are comparatively small and undeveloped.

Additional Australian Records.—King George Sound; Dirk Hartog Island, 7 fathoms; Port Phillip.

Both this and the succeeding species occur at Port Phillip, according to the labels on the specimens at the British Museum; this form, however, appears to be much more common, for, while it is represented by thirteen specimens from that locality, *Pt. mülleri* is only represented by one.

Remarks.—This species was first described from King George Sound in South-western Australia, from specimens brought back to Paris by MM. Quoy and Gaimard, and was subsequently reported as common on the coast of New South Wales. In studying the collections accumulated by the German ship "Gazelle" I found that the species of *Ptilometra* occurring at Dirk Hartog Island was different from that occurring at Sydney, and I accordingly called it *Ptilometra dorcadis*. It now became a question whether this species or the one I considered for the time *macronema* (the one occurring at Sydney) was the true *macronema*

found at King George Sound. Suspecting that *dorcadis* might eventually prove to be true *macronema*, I suggest that, in this case, the species occurring at Sydney may bear the name *mulleri*.

My *Ptilometra dorcadis* was a well marked form, and in examining the collection of the Australian Museum I at once recognised it in two beautiful specimens from Kangaroo Island, near Adelaide. As it occurs both at Dirk Hartog Island and at Kangaroo Island it is safe to say that it also inhabits the intervening territory, including King George Sound, and, therefore, is a synonym of Müller's *Comatula macronema*.

As a necessary consequence the name *macronema* must be restricted to the species occurring from Dirk Hartog Island southward and eastward to Kangaroo Island, while the species occurring at Port Phillip and thence eastward and northward must drop the name *macronema* and adopt that of *mulleri*.

While at Paris I examined the four specimens upon which Müller based his *Comatula macronema*. These are of about the same size as the type of my *Ptilometra dorcadis* from Dirk Hartog Island, and agree with it in all respects. The more proximal segments of the larger cirri (which are disproportionately large) are slightly longer than broad instead of twice as broad as long as in the species from the south-eastern coast (*mülleri*).

PTILOMETRA MULLERI, *A. H. Clark.*

Kallispongia archeri, var., 1877, Wright, Proc. Roy. Irish Acad., [2], vol. 2, p. 754, pl. xl., fig. 3 (*Australia*).

Antedon mauonema, 1885, Bell, Proc. Linn. Soc. N. S. Wales, vol. 9 (1884), p. 497 (*Port Stephens*).

? Antedon wilsoni, 1888, Bell, Ann. and Mag. Nat. Hist., [6], vol. 2, pp. 402, 403 (Port Phillip).—1890, P. H. Carpenter, Proc. Roy. Soc. Vict. (N.S.), vol. 2, p. 135 (*Port Phillip*).

Antedon macronema, 1888, Carpenter, "Challenger" Reports, Zool., vol. 26, p. 212 (*Port Stephens; Port Jackson*, 30-35 *fms*).—1889, Whitelegge, Journ. Roy. Soc. N. S. Wales, vol. 23, p. 198 (*near Sow and Pigs Reef, Port Jackson*).—? 1890, P. H. Carpenter, Proc. Roy. Soc. Vict. [N.S.], vol. 2, p. 135 (*Port Phillip*).—1891, Hartlaub, Nova Acta Acad., German., vol. 58, No. 1, p. 75 (*Sydney*).

Ptilometra mulleri, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 41 (Sydney).

Ptilometra macronema, 1909, H. L. Clark, Mem. Austr. Mus., iv., p. 527 (*off Broken Head*, 28 *fms.*; *off Cape Three Points*, 23-24 *fms.*; *off Manning River*, 22 *fms.*).

Himerometra pædophora, 1909, H. L. Clark, Mem. Austr. Mus., iv., p. 524, pl. xlvii., figs. 4-10 (*off Manning River, 22 fms.*).

Differential Characters.—This species is more delicate and slender than *P. macronema*; the centrodorsal is less thickened and columnar, with the cirrus sockets less regularly arranged; the cirri are shorter and more slender, especially distally, with short proximal segments; the proximal pinnules are more slender and shorter, and all the pinnules have proportionately considerably shorter segments.

Specimens in the Australian Museum Collections.—Port Stephens.—Eighty-four specimens; a moderate sized specimen has nineteen arms 55 mm. long and the longest cirri 50 mm. long with 94 segments; the others are of medium size and have between fifteen and twenty arms.

Nelson's Bay, Port Stephens.—Three medium sized specimens.

Newcastle, 42-78 fathoms.—One specimen with nineteen arms 65 mm. long; two II Br series are lacking, and one III Br series is developed (externally).

Newcastle Bight.—Six medium sized specimens.

Broken Bay.—One medium sized specimen.

Broughton Island.—Two small specimens.

Off Barranjoey.—One stout medium sized specimen with eighteen arms.

Off Port Halliday.—One small ten-armed specimen; the arms are 20 mm. long and the cirri about xv., 47-49, 17 mm. long. This specimen is intermediate between the adult form and the ten-armed young called by Dr. H. L. Clark "*Himerometra pædophora*"; the smaller cirri are of the undeveloped type characteristic of "*pædophora*," but the longer have distally taken on the characters of those of the adult; the cirrus sockets are arranged in two columns in each radial area with a more or less marked midradial space between them as in *Pterometra* and in many of the Thalassometridæ.

Cape Hawke.—Four medium sized specimens with twelve, fourteen, seventeen and eighteen arms; the largest has arms 50 mm. and cirri 40 mm. long.

Port Jackson.—Eleven specimens; one fine large example has nineteen arms 75 mm. long and cirri about l. 84-90, 60 mm. to 65 mm. long; the centrodorsal is 4 mm. high and 6 mm. broad; another large specimen has twenty-three arms 70 mm. long and cirri 50 to 55 mm. long; the smallest specimen has twelve arms 30 mm. long. One very curious individual has twenty-three arms about 65 mm. long, all the II Br and three III Br series being developed; the arms resemble those of ordinary specimens from

the same locality, but the cirri are most extraordinary; there are about fifty of them; at the base they resemble normal cirri, but most of them rapidly taper to a fine point, being only about 7 mm. or 8 mm. long; they appear as if they had all been simultaneously broken off and regenerated, though they are thicker at the base than regenerated cirri; a few, which are broken distally, are rather longer than the majority, though much smaller than usual; the longest stump is 15 mm. long. The colour of the specimen is a uniform slightly pinkish white. The remaining specimens offer no points of especial interest.

Off Manning River, 22 fathoms.—Twenty-three very young ten-armed specimens and twenty-six larger specimens.

Off Broken Head, 28 fathoms.—Four specimens.

Off Cape Three Points, 23-34 fathoms.—Fourteen specimens.

Port Phillip.—One small specimen (see below).

"Australia."—One specimen.

No locality.—Twelve specimens.

Additional Australian Records.—Port Stephens in 6-8 fathoms; Sydney; Port Jackson, 30-35 fathoms; near Sow and Pigs Reef, Port Jackson; Port Phillip.

Remarks.—This species has hitherto always been confused with *P. macronema*, originally described by Müller from King George Sound, from which it is quite distinct.

One of the figures given by Wright in illustrating *Kallispongia archeri*, supposed by him to be a new sponge, probably represents this form, but as the figure is said to represent a varietal form no nomenclatural confusion can result.

In 1888 Professor Bell described his *Antedon wilsoni* from Port Phillip which, so far as I can see, is nothing but the young of the present species, though it was adopted as valid two years later by P. H. Carpenter. More recently Dr. H. L. Clark has again described the young of this species, this time under the name of *Himerometra pædophora*.

The specimens upon which Dr. Clark founded his *Himerometra pædophora* are obviously young, representing a stage just subsequent to the first appearance of P_2. The cirri are only just beginning to become carinate toward the tip, and the distal segments are as yet comparatively long. The sacculi are "abundant and large, especially in distal pinnules" as in the adult, and the disk already "shows many small calcareous plates, largest and most conspicuous around the base of the anal tube." Side and covering plates have not as yet made their appearance.

A specimen from Port Phillip, Victoria, is certainly referable to "*Antedon wilsoni*," and "*Himerometra pædophora*," and no

less certainly to either *Ptilometra mulleri* or *P. macronema*, but which of the two it is impossible to say with accuracy.

The stage represented is somewhat in advance of that described as "*pædophora*," more nearly coinciding with "*wilsoni*."

The ten arms are 25 mm. long, and the cirri, which are xi, two to each radial area excepting one which has three, are 28 mm. to 33 mm. long; the first cirrus segment is short, the second nearly or quite as long as broad, the third slightly longer, the fourth nearly or quite half again as long as broad; the following five or six segments are similar, the succeeding then gradually decreasing in length so that the outer segments are about as long as broad; these shorter distal segments are bluntly carinate; one of the cirri has the tip broken and regenerating as often seen in this species.

The elements of the I Br series have already taken on the characters found in the adult; the I Br_1 is oblong, two and one-half times as broad as long, the I Br_2 broadly pentagonal with the lateral edges about half the length of those of the I Br_1; the elements of the I Br series and the first two brachials have the lateral edges perfectly straight and somewhat produced into a narrow flange-like border by which they are in lateral apposition; a broad synarthrial tubercle is just beginning to develop.

The arms are rounded dorsally with as yet no trace of carination; the pinnules are rounded and not prismatic, though the larger show traces of a prismatic condition in the basal segments; the marginal lappets of the pinnule ambulacra are calcified, but side plates have not yet become differentiated. Syzygies occur between the third and fourth and seventh and eighth brachials, and distally at intervals of two oblique muscular articulations.

While at Cambridge, Massachussetts, in the summer of 1908, I was enabled, thanks to the kindness of Dr. H. L. Clark, to examine some very young specimens, three in number, of *Ptilometra mulleri;* these present many points of difference from the adults, and may be described as follows:—

Centrodorsal thick-discoidal, bearing vii-ix cirri in a single marginal row; these have 25-30 segments of which the two first are about twice as broad as long, the third somewhat longer, the fourth and following about as long as broad; the segments in the outer half of the cirri have the proximal edge of the dorsal half cut away, and are somewhat compressed dorsally, being almost carinate on some of the cirri; penultimate segment with a prominent opposing spine which is terminally situated and reaches in height about one-half the lateral diameter of the segment bearing it; the cirri are comparatively thick at the base and decrease gradually in diameter until about the fourth segment after which they remain of the same diameter.

Ends of the basal rays visible as slight tubercles in the angles of the calyx; radials prominent, strongly concave anteriorly, and somewhat produced in the interradial angles; I Br_1 oblong, twice as broad as long, the lateral edges straight; I Br_2 broadly pentagonal, about half again as long as the I Br_1, the anterior angle rounded, the lateral edges straight continuing anteriorly the lateral edges of the I Br_1; in life the I Br series are probably just in apposition, but the component segments are sharp, not as yet having become flattened against each other.

Ten arms about 20 mm. long; the brachials are mostly wedge-shaped and about as long as broad; the first two are slightly larger than the others; the brachials are all rounded dorsally, with no trace of carination.

Syzygies occur between the third and fourth, seventh and eighth, and usually the eleventh and twelfth (sometimes the ninth and tenth or tenth and eleventh) brachials, and distally at intervals of usually two oblique muscular articulations, though frequently one syzygial pair immediately follows another.

PP_1, $_2$, and $_3$ are small and weak, very short, equal in length to a syzygial pair and one other brachial, composed of five segments, the first about as long as broad, the remainder rather longer than broad; these pinnules taper gradually from the base to the tip; P_4 and the following pinnules are about half again as long and much stouter, composed of about seven ossicles, the first two short, the remainder rather longer than broad; the first three segments are stout, the pinnule thence tapering rather sharply to the tip; the segments are rounded dorsally, but are rather sharply convex, foreshadowing their ultimate prismatic shape.

Sacculi are large and closely set along the ambulacra.

The colour is light purple, the perisome deep purple.

There is as yet no trace of any ambulacral skeleton.

Dr. H. L. Clark described these young specimens (with others somewhat more advanced) as a new species in the genus *Himerometra*. The straight sides of the elements of the I Br series, the tapering cirri, and the uniformity of the proximal pinnules, together with the perisomic plating, especially on the pinnules, seen in the larger specimens, the distribution of the syzygies, and the abundance and large size of the sacculi, as well as the very characteristic musculature show conclusively that these specimens cannot be any species of *Himerometra*, young or old, but that they must belong to the genus *Ptilometra*; in fact if one can for the moment overlook the obsolescence or absence of carination on the outer part of the arms and on the pinnules—a character always late in making its appearance—the relationship is at once evident. Dr. Clark says,—"Fortunately, however, there are

young specimens of *Ptilometra* in the collection as small as the larger specimens of *pædophora*, and it is possible, therefore, to show that the two are not even nearly allied forms; the conical centrodorsal, the long cirri and the crowded prismatic pinnules distinguish the Ptilometras at a glance. Moreover, it should be noted that pentacrinoid larvæ were not present on the pinnules of any undoubted *Pt. macronema* [*i.e.*, *mulleri*] . . It is difficult for me to believe that the smallest Ptilometras, too young to have assumed any of their characteristic generic or specific features, shoul l be the only ones which are breeding."

Answering the last statement first, I some time ago[6] showed that it is rarely the adults of any species which bear Pentacrinoid young upon their pinnules or cirri, but usually young ones; the free swimming young always drift to leeward of the parents before settling down; at the next breeding season another brood drifts over to the place occupied by the brood of the preceding season and settles down upon it. Thus it is that while young Comatulids often bear Pentacrinoids they are very rarely found on the fully grown. There are some nice examples of this in the Museum at Cambridge, where the cirri of some young specimens of *Comactinia meridionalis* are preserved bearing Pentacrinoids upon them, and I have seen some scores of additional cases of the same thing.

The Comatulids change from their comparatively undeveloped post-Pentacrinoid condition to the perfect form very quickly; this is accompanied by a rapid development of P_2 and the immediately succeeding pinnules, a great increase in the width of the pinnulars and the brachials which make the pinnules appear much closer together and the brachials shorter, and, in species with long cirri, by a rapid (distal) addition to the cirrus segments, the added segments as they appear becoming progressively more and more developed. In the Thalassometridæ and in the Tropiometridæ the carination of the brachials and pinnules is never present in the very young, but is rather suddenly assumed at an early stage; a graphic recapitulation of this may be observed in any regenerating specimen.

Dr. Clark has failed to mention a single character by which his *pædophora* can be distinguished from the young of *Ptilometra mulleri* as predicated from the facts known in regard to the young of related species and, as we have now been able to study a specimen exactly intermediate between the *pædophora* stage and the adult condition, there seems to be no escape from the conclusion I had arrived at, and communicated to him, when Dr.

[6] Vidensk. Medd. fra den Naturhist. Forening i Kjobenhavn, 1909, p. 120.

Clark first showed me his *pædophora*, namely, that *pædophora* is nothing but the young of *Ptilometra mulleri*, the sacculi, the broad I Br series and first two brachials, the syzygies, and the ambulacral plating of the larger specimens preventing its reference to any species outside of that genus.

Genus STIREMETRA, *A. H. Clark.*

Stiremetra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 15 (ANTEDON ACUTIRADIA, P. H. Carpenter, 1888).

Differential Characters.—In *Stiremetra* as in *Ptilometra* the pinnules are prismatic and stout, with the ambulacral grooves bordered by side and covering plates; these are much better developed than in *Ptilometra*, however, and P_1, instead of being smaller and shorter than P_2 as in *Ptilometra*, is much enlarged and much longer than the following pinnules. The centrodorsal is hemispherical or bluntly conical, with the cirrus sockets arranged in ten columns of usually two sockets each. The lower part of the animal is compressed, so that the elements of the I Br series and the lower brachials are sharply flattened against each other laterally. There are only ten arms.

Range.—Kermadec Islands and Port Jackson to Fiji and the Philippines; mostly in deep water, but one species is littoral.

STIREMETRA ARACHNOIDES (*A. H. Clark*).

Stenometra arachnoides, 1909, A. H. Clark, Proc. U.S. Nat. Mus., vol. 36, p. 402 (OFF TAWI TAWI, PHILIPPINES, 12 FMS.; *Port Denison*).

A specimen of this species was found in the jar containing the type specimen of *Amphimetra discoidea*. The U.S. National Museum received these Crinoids many years ago in exchange from the Australian Museum. They were collected at Port Denison, Queensland.

This specimen and the type, which was obtained by the "Albatross" in the Philippine Islands, are the only examples of this interesting form so far known.

Suborder MACROPHREATA, *A. H. Clark.*

Family ANTEDONIDÆ, *Norman*

Subfamily ANTEDONINÆ, *A. H. Clark.*

Genus COMPSOMETRA, *A. H. Clark.*

Compsometra, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 131 (ANTEDON LOVENI, Bell, 1882,=*Antedon pumila*, Bell, 1884).

Differential Characters.—The species of *Compsometra* are readily distinguished from those of any other Australian genus by their very small size, the very long P_1, which is slender and composed of elongated segments, the delicate cirri which have less than fifteen segments, long and "dice-box shaped," at least in the proximal half, and the regularity in the distribution of the syzygies.

Range.—*Compsometra* ranges from Southern Australia to Southern Japan and the Hawaiian Islands.

COMPSOMETRA LOVENI (*Bell*).

? *Kallispongia archeri*, 1877, Wright, Proc Roy. Irish Acad., [2], vol. 2, p. 754 (AUSTRALIA).

Antedon loveni, 1882, Bell, Proc. Zool. Soc., 1882, p. 534 (PORT JACKSON, 0-5 FMS.).—1908, A. H. Clark, Proc. U.S. Nat. Mus., vol. 34, p. 481.

Antedon pumila, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 157, pl. x., figs. B, B*a*, *b* (based on the same specimens as the preceding).—1885, Proc. Linn. Soc. N.S. Wales, vol. 9 (1884), p. 497 (*Nelson's Bay, Port Stephens*).—1889, Ann. and Mag. Nat. Hist., [6], vol. 3, p. 292.—1889, Whitelegge, Journ. Roy. Soc. N.S. Wales, vol. 23, p. 197 (*Port Jackson, deep water; Taylor Bay; Watson's Bay.*—1890, P. H. Carpenter, Proc. Roy. Soc. Vict., (N.S.), vol. 2, p. 135 (*Port Phillip*).—1890, Ramsay, Rec. Austr. Mus., vol. 1, p. 84 (*Port Jackson*).

Differential Characters.—This delicate little species may readily be distinguished from *C. lacertosa* by its much more slender cirri in which the segments preceding the penultimate are at least half again as long as broad.

Specimens in the Australian Museum Collection.—Claremont Island, 11 fathoms—One typical specimen.

Nelson's Bay, Port Stephens—Forty-three specimens; six of these are deep purple, the remainder being dull greyish-yellow more or less tinged with brown.

Port Halliday.—Fragments.

Broughton Island.—Eight specimens; four are yellow, three brown, and one deep purple with each segment of the arms, pinnules, and cirri bordered with white.

Bottle and Glass Rocks, Port Jackson.—Thirty-four specimens.

Port Jackson.—Six hundred and forty-six specimens.

This magnificent series shows that when adult this species ordinarily possesses an arm length of 30 mm. to 35 mm., the cirri being xv-xxx, 12-14, 7 mm. to 8 mm. long; occasionally larger individuals occur, the largest having an arm length of 70 mm. while one is bearing eggs which has arms only 20 mm. long.

In colour the great majority (587) are dull greyish-yellow tinged with brown, the cirri and the proximal portions of the arms being lighter than the rest; fifty-two of them are a rather dark brown or purple with light yellowish cirri and arm bases; seven have each segment of the arms, pinnules, and cirri deep purple in the centre, the borders being white, this giving them a beautiful and striking "pepper and salt" appearance.

This lot also included four Pentacrinoid young attached to seaweeds.

"Australia."—Twenty-eight specimens.

Additional Australian Records.—Port Jackson, 0-5 fathoms; Nelson's Bay, Port Stephens; Port Phillip.

Remarks.—It is probable that this is the species upon which Wright's *Kallispongia archeri* was mainly founded, though no definite assertion to that effect can be made. In 1882 Bell listed this species with a so-called specific formula which he evidently believed to be diagnostic, thus technically naming it; two years later, however, he chose a new name for it under which it appears in the "Alert" Report, the original name having been shifted to a species which he at first had called "*insignis.*" Bell described P_1 as shorter than P_2, and so, when he received some additional specimens from Port Phillip he failed to recognise his species, and bestowed a third name upon it. Whitelegge, who was familar with the animal in life, had discovered the error in Bell's description as given in the "Alert" Report, and rectified it just as Bell himself discovered it and published a short note to that effect. By a curious circumstance it happened that, though Whitelegge was right in his statement in regard to this form, Bell was in error; for the specimens upon which Bell had founded his *Antedon incommoda* do not belong to this species at all, but are representatives of the species which has recently been called *lacertosa.*

Whitelegge, in his list of the Crinoids of Port Jackson, says:—"In the description of this species the first pinnules are said to be the shortest; this is incorrect, the first pinnules are the longest. Very common in deep water, occasionally found under stones; Taylor Bay; Watson's Bay. The stalked or larval form is often found attached to seaweeds. August-September."

It is interesting to find that this species, like the European *Antedon*, breeds in the early spring, apparently as early in the season as the conditions will permit.

COMPSOMETRA INCOMMODA (*Bell*).

Antedon, sp. nov., 1889, P. H. Carpenter, Proc. Roy. Soc. Vict., (N.S.), vol. 1, p. 135 (*Port Phillip*).

Antedon incommoda, 1888, Bell, Ann. and Mag. Nat. Hist. (6), vol. 2, p. 404 (PORT PHILLIP).—1889, Bell, *idem*, vol. 3, p. 292 (*supposed identity with A. pumila*).

Compsometra lacertosa, 1910, A. H. Clark, Proc. U.S. Nat. Mus., vol. 38, p. 275 (PORT JACKSON).

Differential Characters.—*Compsometra incommoda* is a somewhat stouter species than *C. loveni*, the cirri especially being stouter, with the three or four segments preceding the penultimate broader than long.

Description.—Centrodorsal discoidal, rather thin, with a broad flat polar area nearly or quite 2 mm. in diameter; cirrus sockets arranged in two very closely crowded more or less irregular marginal rows.

Cirri xxxiv-xxxvi., 9-12 (usually 10) 7 mm. long, the extreme flatness of the centrodorsal which, however, bears very numerous cirri very closely crowded and almost in the same plane, short, and rather strongly decurved distally, gives the dorsal part of the animal a striking resemblance to certain species of *Catoptometra* or *Oligometra*, and renders it very unlike that of any other macrophreate form. First cirrus segment very short, second nearly or quite as long as broad, fourth and fifth the longest, about half again as long as the median diameter; following segments gradually decreasing in length so that the last two are about as long as broad; opposing spine minute, slender, subterminal, directed slightly forward; terminal claw long, nearly twice as long as the penultimate segment, evenly tapering and moderately and evenly curved. The second and following segments are slightly constricted centrally, this character gradually disappearing distally as the segments become shorter; the longer proximal segments are rounded in cross section and comparatively narrow in lateral view, but the segments become laterally flattened distally and appear laterally broader, like the cirri of *Antedon petasus*.

Disk as in *Compsometra loveni*; sacculi rather small but very numerous along the ambulacra of the disk, arms, and pinnules.

In good specimens the division series are entirely hidden by the dense circlet of cirri; radials even with the edge of the centrodorsal; the I Br series extend outward horizontally as in *Comatula* so that the entire animal is flat as in the ten-armed Comasterids; I Br_1 very short, slightly trapezoidal, about four times as broad as long; I Br_2 almost triangular, the lateral edges, which are slightly shorter than those of the I Br_1, making with

the sides of that ossicle almost a right-angle, about as broad as long, the distal angle considerably produced.

Ten arms 60 mm. to 65 mm. long, rather stout in the basal third but becoming exceedingly slender distally ; first brachial short, almost oblong, two to two and one-half times as broad as long in the median line, barely in contact basally interiorly, the diverging interior edges making a very broadly obtuse angle ; second brachial much larger, almost triangular, about as broad as the greatest length ; third and fourth brachials (syzygial pair) wedge-shaped, twice as long interiorly as exteriorly, about as broad as the interior length ; following three brachials about twice as broad as the median length, slightly wedge-shaped, then becoming very obliquely wedge-shaped, almost triangular, about as broad as long, further out on the arm less oblique, and in the terminal portion much elongated and centrally constricted, twice as long as broad or even longer ; fifth and following brachials with rather strongly overlapping spinous distal edges, this character becoming less marked in the outer portion of the arm.

Syzygies occur between the third and fourth brachials, again between the ninth and tenth and fourteenth and fifteenth, and distally at intervals of three oblique muscular articulations.

P_1 11 mm. long, slender and flagellate, with thirty to thirty-two segments ; first segment short, following three or four about as long as broad, then rapidly becoming elongated and after three or four more about twice as long as broad, somewhat longer distally ; second and two or three following segments with the distal edges strongly produced, overlapping, and finely spinous, but this gradually dies away as the segments become elongated so that most of the pinnule is smooth ; the elongated segments have slightly expanded ends ; P_2 5 mm. long, slightly less stout basally than P_1, with sixteen to twenty segments, the first exceedingly short, the next two about as long as broad, the following becoming elongated and about twice as long as broad distally ; second, third and fourth with strongly overlapping distal dorsal ends, this feature dying away on the three or four following segments ; P_3 about 5 mm. long resembling P_2 with about fifteen segments, of which the proximal have much more strongly produced and overlapping distal ends, and this character is prominent on all the segments almost to the tip of the pinnule ; the third-twelfth segments bear a large rounded genital gland ; following pinnules similar to P_3 but slightly longer (5·5 mm.) with somewhat larger genital glands ; after P_{10} the genital glands slowly decrease in size and finally disappear on P_{16} ; distal pinnules exceedingly slender, about 4 mm. long, with large and thickly set sacculi.

The colour is a dull greenish grey.

Specimens in the Australian Museum Collection.—Port Jackson —Five specimens.

Additional Australian Record.—Port Phillip.

Remarks.—In examining the Comatulids in the British Museum I was greatly surprised to find that the types of Bell's *Antedon incommoda* consist of two specimens of the form which I had called *Compsometra lacertosa*, and one young *Ptilometra;* Bell himself placed *incommoda* unhesitatingly in the synonymy of his previously described *loveni* or *pumila.*

CRINOIDS KNOWN FROM THE DEEP WATER ABOUT AUSTRALIA.

While the present Memoir is concerned only with the littoral and sublittoral Crinoids of Australia, some mention should be made of such species as are known to occur in the deep sea surrounding that continent. While on her epoch-making voyage around the world, the "Challenger" made three hauls off the Australian coast at which Crinoids were obtained in depths varying from 950 to 2,600 fathoms; a number of years afterwards Capt. F. Worsley, of the cable-repair ship "Sherard Osburn," while working on the Sahul Bank, secured several very interesting species which were reported upon, after the death of Dr. P. H. Carpenter, to whom they were originally sent, by Prof. F. J. Bell. Thanks to the kindness of Dr. Nelson Annandale, of the Indian Museum, Calcutta, the specimens collected by Capt. Worsley belonging to that institution are now before me. The species obtained on the Sahul Bank are comparatively shallow water forms, and probably came from near the 100 fathoms line —at least most of them. They include the only stalked Crinoid so far known from the vicinity of Australia.

I. COMATULIDS.

Suborder OLIGOPHREATA, *A. H. Clark.*

Family THALASSOMETRIDÆ, *A. H. Clark.*

Genus ASTEROMETRA, *A. H. Clark.*

ASTEROMETRA MIRIFICA, *A. H. Clark.*

Antedon longicirra (part) (not of Carpenter), 1893, Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 339.

Asterometra mirifica, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 146.

Sahul Bank (10° 30′ S. lat., 125° E. long.).

ASTEROMETRA ACERBA, *A. H. Clark.*

Antedon longicirra (part) (not of Carpenter), 1893, Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 339.

Asterometra acerba, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 147.

Sahul Bank.

Genus COSMIOMETRA, *A. H. Clark.*

COSMIOMETRA WOODMASONI (*Bell*).

Antedon wood-masoni, 1893, Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 340, pl. xxiii., pl. xxiv., fig. 1.

Cosmiometra woodmasoni, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 17.

Sahul Bank.

Genus STIREMETRA, *A. H. Clark.*

STIREMETRA SPINICIRRA (*P. H. C.*).

Antedon spinicirra, 1888, P. H. Carpenter, "Challenger" Report, Zool., vol. 26, p. 112, pl. xi., figs. 1, 2.—1889, Whitelegge, Journ. Roy. Soc. N.S. Wales, vol. 23, p. 198.

Stiremetra spinicirra, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 15.

Off Port Jackson (34° 08′ S. lat., 152° 00′ E. long.), 950 fathoms.

Family CHARITOMETRIDÆ, *A. H. Clark.*

Genus PACHYLOMETRA, *A. H. Clark.*

PACHYLOMETRA PATULA (*P. H. C.*).

Antedon patula, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 219, pl. xliii.—1893, Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 341, pl. xxiv., figs. 2-6.

Pachylometra patula, 1909, A. H. Clark, Proc. Biol. Soc. Washington, vol. 22, p. 21.

Sahul Bank.

Suborder MACROPHREATA, *A. H. Clark.*

Family ANTEDONIDÆ, *Norman.*

Subfamily BATHYMETRINÆ, *A. H. Clark.*

Genus BATHYMETRA, *A. H. Clark.*

BATHYMETRA CARPENTERI, *A. H. Clark.*

Antedon abyssicola, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 191 (part), pl. xxxiii., fig. 2.

Bathymetra carpenteri, 1908, A. H. Clark, Proc. U.S. Nat. Mus., vol. 34, p. 235.

South-west of Melbourne (42° 42′ S. lat., 134° 10′ E.), 2,600 fathoms.

Family PENTAMETROCRINIDÆ, *A. H. Clark.*

Genus DECAMETROCRINUS, *Minckert.*

DECAMETROCRINUS ABYSSORUM (*P. H. C.*).

Promachocrinus abyssorum, 1888, P. H. Carpenter, "Challenger" Reports, Zool., vol. 26, p. 351, pl. i., figs. 4, 5, pl. lxix., figs. 5-7.

Decametrocrinus abyssorum, 1905, Minckert, Zool. Anzeiger, vol. 28, p. 494.

South-west of Melbourne (50° 01′ S. lat., 123° 04′ E. long.), 1,800 fathoms.

Genus PENTAMETROCRINUS, *A. H. Clark.*

PENTAMETROCRINUS SEMPERI (*P. H. C.*).

Eudiocrinus semperi, 1882, P. H. Carpenter, Journ. Linn. Soc. (Zool.), vol. 16, p. 497.—1888, "Challenger" Reports, Zool., vol. 26, p. 82, pl. iii., fig. 7, pl. vi., figs. 1-3.—1889, Whitelegge, Journ. Roy. Soc. N.S. Wales., vol. 23, p. 197.

Pentametrocrinus semperi, 1908, A. H. Clark, Proc. Biol. Soc. Washington, vol. 21, p. 135.

Off Port Jackson (34° 08′ S. lat., 152° 00′ E. long.), 950 fathoms.

PENTAMETROCRINUS, *sp.*

Thaumatocrinus renovatus, 1884, P. H. Carpenter, Phil. Trans. Roy. Soc., 1883, p. 919.

South-west of Melbourne (50° 01′ S. lat., 123° 04′ E. long.), 1,800 fathoms.

II. STALKED CRINOIDS.

Family PENTACRINITIDÆ, *Gray.*

Genus METACRINUS (*P. H. C.*).

METACRINUS INTERRUPTUS (*P. H. C.*).

Metacrinus interruptus, 1884, P. H. Carpenter, "Challenger" Reports, Zool., vol. 11, p. 367, pl. lii.—1893, Bell, Journ. Linn. Soc. (Zool.), vol. 24, p. 339.

Sahul Bank.

UNIDENTIFIABLE LIST.

ENCRINUS AUSTRALIS, *Pleydell.*

Encrinus australis, 1845, Pleydell, L'Institut, 13 août, 1845, p. 292 (see p. 711).

ENCRINITE.

Encrinite, 1862, Owen, Ann. and Mag. Nat. Hist., (3), vol. 9, p. 486 (see p. 712).

ANTEDON, *sp.*

Antedon, sp. (near "*macronema*"), 1894, Bell, Proc. Zool. Soc. 1894, p. 394 (*N. W. Australia, ? fms.*).

While in London I examined the specimen upon which this record is based, and found it to be an example of the *Cenometra cornuta* described herein (p. 772).

ANTEDON ADEONÆ.

Antedon adeonæ, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 156 (part).

Among the "Alert" collections at London there are some curious Comatulids from Port Molle (12-20 fathoms) and from "Alert" Station No. 87, recorded under the name of "*Antedon adeonæ*," which represent a very distinct new species, possibly belonging to the genus *Tropiometra*. I was not able while in London to spare the time to work this species out satisfactorily.

COMPSOMETRA, *sp.*

In the British Museum there are eleven specimens of a species of *Compsometra* from Lewis Island in the Dampier Archipelago; I was not able to determine them specifically while visiting that institution because of lack of time.

ANTEDON, *sp.*

Antedon, sp., 1885, Bell, Proc. Linn. Soc. N.S. Wales, vol. 9 (1884), p. 498.

Professor Bell gives a nominal list of Crinoids included in a collection from New South Wales placed in his hands for determination; in addition there were "several species of *Antedon*, hitherto undescribed, but here unfortunately represented by single, not always perfect, specimens."

ANTEDON, *sp.*

Antedon, sp., 1889, Studer, Die Forschungsreise S.M.S. "Gazelle," iii. Thiel, Zool. und Geol., p. 184.

Professor Studer records an undetermined species which he referred to this genus which was taken in 25° 50·8′ S. lat., 112° 36·8′ E. long. (off Dirk Hartog Island), two sea miles from land, in 45-60 fathoms, with a bottom temperature of 21° C. The specimen was of a deep violet colour in life.

COMATULA, *sp.*

Comatula, sp., 1889, Studer, Die Forschungsreise S.M.S. "Gazelle," iii. Thiel, Zool. und Geol., p. 195.

Two ten-armed Comatulids are recorded from 19° 41·1′ S. lat., 116° 49·8′ E. long., off the west coast of Australia, in 91·5 meters, with a bottom temperature of 14.7° C. The colour of one is recorded as purple, of the other as pale yellow; the latter is probably a Thalassometrid.

ANTEDON, *sp.*

Antedon, 1893, Kent, The Great Barrier Reef of Australia; its Products and Potentialities, p. 43, pl. xi., figs. 7, 7*a*.

"Two other members of the same echinodermatous, or sea-urchin and starfish, class, observed on the Palm Island reefs, are depicted in the same coloured plate. These are the two Feather-starfish, *Antedon* sp., represented by Figs. 7 and 7*a*, clinging to the corallum of the Gorgonia in the right hand upper corner. In general form they resemble the English Feather-star, *Comatula rosacea* [*i.e.*, *Antedon bifida*]; but they possess about forty, in place of the ten, pinnate arms of the European type. The variety of hues exhibited by this Barrier Reef species are legion, running through every gradation of tint from pale yellow to rose-pink, deep crimson and black, and including every conceivable intermixture of these colours. One especially handsome racial variety of this Feather-star, obtained at Thursday Island,

had its fern-like arms resplendent with shades of old-gold and bronze-green."

ACTINOMETRA, *sp.*

Actinometra, 1894, Walther, Einleitung in die Geologie als historische Wissenschaft, p. 298.

Walther records an undetermined species of "*Actinometra*" as very common at Somerset, Queensland, in 15-22 meters. Probably this is *Comatula solaris* or *C. rotalaria*.

ACTINOMETRA CUMINGII, *Bell.*

Actinometra cumingii, 1884, Bell, Rep. Zool. Coll. H.M.S. "Alert," p. 167.

Port Molle.—"A delicate specimen with 10 cirri, the cirri having about 12 joints and no penultimate spine, and most of the joints being a little longer than broad, is referred to this species. Two of the arms which have undergone injury are now giving rise to four and three arms respectively."

If this description is accurate, this can only be a specimen of *Comatula rotalaria* which is just undergoing adolescent autotomy; this is the only multibrachiate Australian Comasterid with no dorsal processes on the cirri and with "most of the [cirrus] joints a little longer than broad."

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Editorial Note.—At p. 711 Mr. Clark refers to a notice in "L'Institut" of 1845, p. 292, of the discovery of a new Encrinite at Newcastle, N.S. Wales, by the Rev. "C. Pleydell." Whilst reading the proofs of this Memoir, I felt convinced I had, in previous years, somewhere seen another reference to this "Encrinite," but could not, for the time being, remember where. By pure accident, on looking through some old memoranda, I came upon the original reference. The clergyman referred to was the Rev. "C. Pleydell N. Wilton," of Newcastle, and his paper, under the title of—"*On a New Species of Encrinite* (Encrinus Australis)," and of which the notice in "L'Institut" is clearly an extract, was published in the "Tasmanian Journal of Natural Science," 1843, ii., No. vii., pp. 118-120.

It is quite evident from the tenor of his paper Mr. Wilton had many specimens. They were only found on the beach or in rock-pools, adhering to sea-weed, after gales. Examples of this

organism were sent to Oxford previous to 1841, and presented to the Ashmolean Society. The following is Mr. Wilton's description verbatim :—

"The *Encrinus Australis* has no vertebral column, but its body, which is about $\frac{1}{5}$th of an inch in length, is terminated in that direction by a circular base ; the circumference of the body being indented by three rows of irregularly shaped hollow sections, each furnished with a circular orifice, to which the several tentacula of about 80 joints, and curving inwards towards their extremities, are appended, and by which the animal attaches itself to the sea-weed, which adheres to the bottom of the water-hole in the rock. To the opposite extremity of its body, which is always uppermost in the water, are attached five clavicles. Upon removing these from the body, its inferior surface presents a star of five points, each point being set in the angle formed by the two approaching segments of a circle, on which each of the clavicles reposed. Within this star is another star, also of five points. To each of these clavicles are attached two scapulæ, into each of which the first two bones of the animal are inserted. On each of these is another scapula, from which proceed two arms. To two opposite sides of every alternate articulation of these arms, which gradually diminish in size to the extremity, are attached fingers, gradually tapering to a point, formed of several joints, which appear to vary in number according to the size and age of the specimen. In one of these I have counted twenty. Each of the joints of the arms is of a circular figure, with an oval orifice in the centre, from which proceed radii to the circumference. With its fingers, which the animal can either extend or contract at pleasure, either in a lateral or perpendicular direction, and which all curve outwards, the *Encrinus Australis* presents an appearance under the water of that species of lily called the Turk's cap, and of a beautiful lilac colour."

R. E.

9th August, 1911.

12009

AUSTRALIAN MUSEUM, SYDNEY.

MEMOIR IV.

SCIENTIFIC RESULTS

OF THE

TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS"

OFF THE COAST OF NEW SOUTH WALES,

IN

FEBRUARY AND MARCH, 1898.

PART 16.

HYDROZOA (HYDROID ZOOPHYTES AND STYLASTERINA).

Published 30th November, 1911.

PUBLISHED BY ORDER OF THE TRUSTEES.

R. ETHERIDGE, Junr., J.P., Curator.

SYDNEY, 1911.

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PART XVI.

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Hydrozoa (Hydroid Zoophytes and Stylasterina), by James Ritchie 805

HYDROZOA (HYDROID ZOOPHYTES AND STYLASTERINA) OF THE "THETIS" EXPEDITION.

By JAMES RITCHIE, M.A., B.Sc, The Royal Scottish Museum, Edinburgh.

HYDROZOA (HYDROID ZOOPHYTES AND STYLASTERINA).

By James Ritchie, M.A., B.Sc., The Royal Scottish Museum, Edinburgh.

(Plates lxxxiv.-lxxxix., and fig. 126.)

Despite the fact that Hydroid Zoophytes were obtained by the "Thetis" at only eleven of the fifty-nine definite stations at which dredgings were made, the collection is one of great variety and of much interest. Most striking in a general survey of the collection, is the high percentage of forms the structures of which are markedly different from those of the species of any other region; for, in the total of thirty-eight species and varieties which the collection contains, fifteen have been found only in Australian seas.

On this account the main interest of the present Report lies in the additional information which it offers regarding the morphology of species of great rarity, and regarding the variations of structure to which these, and the more widely distributed forms here represented, are subject. The characters of several of the specimens are so distinct from those recorded that I have found it necessary to establish for them eight new species and varieties, distributed amongst the genera *Lictorella* (1 sp.), *Cryptolaria*, (1 sp. and 2 vars.), a genus not hitherto known from the Australian area, *Sertularella* (1 sp. and 1 var.), *Halicornaria* (1 sp.), and *Cladocarpus* (?) (1 sp.), also recorded for the first time from Australia. Of these the most interesting, from a general point of view, is the dimorphic variety of *Cryptolaria crassicaulis*, which throws light on the phylogenetic origin of *Cryptolaria*, and emphasises the close relationship that exists between that genus and *Lafoëa*. The gonosome of the widely distributed *Lafoëa serrata* has been described for the first time. The comparative rarity of Gymnoblastic forms and of minute epizoic species is noticeable.

As to the geographical significance of the collection:—Thirteen species and one variety, each indicated by an asterisk in the following list, have been added to the Hydroid fauna of Australian seas, one of which, *Cladocarpus bathyzonatus*, is particularly noteworthy in that it belongs to a well-marked section of the genus *Cladocarpus*, which has hitherto been regarded as confined to American waters. While it would be presumption to endeavour to deduce with minuteness the wider relationships of

the Hydroid fauna of South-east Australia, from a collection limited to about half the known species in that area, the general facts are clear. That, although an unusually large proportion of this fauna is peculiar to Australia, there are also many species common to it and other oceanic regions. These do not appear to bear out the statement of W. M. Bale[1] that "the Hydroida of the South-eastern province have more affinity with those of New Zealand than with these of any other part of the globe." For, of the twenty-two species concerned, thirteen have been found in the Indian Ocean, thirteen in the Atlantic, and ten in the Pacific, while only six occur in the neighbourhood of New Zealand. Miss L. R. Thornely has, however, justly drawn attention to the similarity which exists between the Hydroid fauna of Indian seas and that of Australia,[2] for it is probable the latter is more closely allied to the former than to any other.

As regards the local distribution:—The average number of species obtained at the productive Stations is slightly under five, the Stations at which larger numbers were obtained being 36 (8 spp.), 44 (13 spp.), 48 (9 spp.), 54 (9 spp.), 57 (6 spp.). Examination of the provenance of the specimens would lead one to suppose that the Hydroid fauna was most abundant in the coastal region which lies between Port Jackson and Bulgo (to the south of Port Hacking), but this supposition is discounted by the fact that it was precisely in this area that the collecting of the "Thetis" was most intense.

Besides the Hydroid Zoophytes proper, there has been included in this report *Stylaster eximius*, the only calcareous Hydrozoon received by me. It has not hitherto been recorded from Australia.

I cannot conclude this introduction to the description of a highly interesting Australian collection of Hydrozoa, without paying tributes to the unrivalled work accomplished for Australian Zoophytology by Mr. W. M. Bale in his admirable "Catalogue," published by the Trustees of the Australian Museum, supplemented by his later papers; and to the painstaking studies of Dr. Armand Billard, whose examinations of type specimens have done much to free the literature of Hydroids from mystifying synonyms.

Finally, I would express my thanks to the Trustees of the Australian Museum for entrusting to me, for examination, the collection brought together by the "Thetis."

18th January, 1911.

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[1] Bale—Cat. Austr. Hydroid Zoophytes, Sydney, 1884, p. 32.

[2] Thornely—in Herdman, Rep. Ceylon Pearl Oyster Fisheries, Part ii., Suppl. Rep. viii.—Hydroida, p. 107.

List of Species.

Phylum **COELENTERATA.**

Class HYDROZOA.

Order GYMNOBLASTEA.

Family HYDROCERATINIDÆ.

Clathrozoon wilsoni, Baldwin Spencer.

Family EUDENDRIDÆ.

Eudendrium, sp. indet.

Order CALYPTOBLASTEA.

Family HALECIDÆ.

Halecium flexile, Allman (?).
**Halecium sessile*, Norman.

Family CAMPANULARIDÆ.

**Campanularia hincksii*, Alder, var. *grandis*, Billard.
Campanularia tincta, Hincks (?).
**Clytia elongata*, Marktanner-Turneretscher.
Hebella calcarata (A. Agassiz).

Family LAFOEIDÆ.

Lafoëa gracillima (Alder), forma *typica*.
**Lafoëa serrata*, Clarke.
**Lafoëa tenellula*, Allman.
Lictorella antipathes (Lamarck).
**Lictorella concinna*, sp. nov.
**Cryptolaria arboriformis*, sp. nov.
**Cryptolaria conferta*, Allman, var. *australis*, var. nov.
**Cryptolaria crassicaulis*, Allman, var. *dimorpha*, var. nov.
Perisiphonia exserta (Johnson).

Family SERTULARIDÆ.

**Sertularella adpressa*, sp. nov.
Sertularella divaricata (Busk), var. *subdichotoma*, Bale.
Sertularella longitheca, Bale, *typica*.
**Sertularella longitheca*, Bale, *robusta*, var. nov.
**Sertularella turgida* (Trask), ?.
Thuiaria sinuosa, Bale.
Sertularia elongata, Lamouroux.
Sertularia minima, Thompson.
Synthecium cylindricum (Bale).
Synthecium orthogonium (Busk).
Diphasia subcarinata (Busk).

Family PLUMULARIDÆ.

Plumularia setacea (Linnæus).
Plumularia sulcata, Lamarck.
Diplocheilus mirabilis, Allman.
Halicornopsis elegans (Lamarck).
Halicornaria furcata, Bale.
Halicornaria prolifera (Bale).
**Halicornaria thetidis*, sp. nov.
**Cladocarpus*(?) *bathyzonatus*, sp. nov.
Aglaophenia crucialis, Lamouroux.
Aglaophenia divaricata (Busk).

Order STYLASTERINA.

Family STYLASTERIDÆ.

**Stylaster eximius*, Saville Kent.

Phylum **COELENTERATA.**

Class HYDROZOA.

Order GYMNOBLASTEA.

Family HYDROCERATINIDÆ.

CLATHROZOON WILSONI, *Baldwin Spencer.*

Clathrozoon wilsoni, Spencer, Trans. Roy. Soc. Vict., ii., 1, 1891, p. 123, pls. 17-20, figs. 1-16. *Id.*, Bale, Proc. Roy. Soc. Vict., (n.s.), vi., 1894, p. 96.

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* Indicates that the species is here recorded for the first time from Australian seas.

The skeleton of a single dried colony is a little over one foot in height. It originally consisted of three almost equally developed branches, of which two remain. The stem is 18 mm. in diameter at the base. The habit of the colony resembles that of some of the Gorgonid Alcyonarians of the genus *Juncella;* but the growth is not so luxurious nor so sturdy as in the specimen figured by Spencer (Pl. 17, fig. 1), although the colony somewhat exceeds his in height. The diameter of the aperture of a hydrophore was found to vary from 0·12 to 0·18 mm.

Locality.—Off the coast of New South Wales.

The species has hitherto been found only in Bass Strait, near Port Phillip Heads, Victoria.

Family EUDENDRIDÆ.

EUDENDRIUM, *sp. indet.*

Station 36.

Poor specimens, without cœnosarc, and consisting of short stems from which a few branches with ringed bases arise, represent an indeterminable species of *Eudendrium.* It is probable that the specimens belong to the species *Eudendrium pusillum,* which von Lendenfeld[3] recorded from Port Jackson, in the same neighbourhood in 1885, and which Miss Thornely has since described from the Gulf of Manaar.[4]

Locality.—Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898.

Order CALYPTOBLASTEA.

Family HALECIDÆ.

HALECIUM FLEXILE, *Allman* (?).

Halecium flexile, Allman, Rep. Sci. Results "Challenger" Exped., Zool., xxiii., Hydroida, pt. ii., 1888, p. 11, pl. xi., figs. 2, 2*a*. *Id.*, Hartlaub, Zool. Jahrb. Jena, Suppl. vi., iii., 1905, p. 611, figs. J[3], K[3]. *Id.*, Billard, Ann. Sci. Nat. (n.s.), xi., 1910, p. 3.

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[3] Von Lendenfeld—Proc. Linn. Soc. N.S. Wales, ix., 1885, p. 352.

[4] Thornely—in Herdman, Ceylon Pearl Oyster Fisheries, Part ii., Suppl. Rep., viii.—Hydroida, p. 110.

Halecium gracile, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 759, pl. xiv., figs. 1-3. *Id.*, Bale, Proc. Roy. Soc. Vict. (n.s.), vi., p. 99. *Id.*, Jäderholm, Ark. för Zool. Stockholm, i., 1903, p. 266, pl. 12, figs. 2, 3.

Halecium parvulum, Bale, Proc. Linn. Soc. N.S. Wales (2), iii., 1888, p. 760, pl. xiv., figs. 4, 5. Marktanner-Turneretscher, Ann. K.K. Hof-mus. Wien, v., 1890, p. 218, pl. iii., fig. 22.

Station 44.

To this species I refer, with some hesitation, a very fragmentary specimen, without gonosome. The stem is weakly fascicled at the base, and the hydrothecæ resemble those in the figure by Allman, rather than those in that by Bale, although rarely an example with much everted margin occurs. The hydrothecæ, however, lie more closely to the stem than do those in Allman's figure. The size of the hydrothecæ and their rapid widening from base to margin are notable.

Dimensions.—

Stem internode, length.....	0·61-0·77 mm.
„ „ diameter.....	0·19-0·24 „
Hydrotheca, depth	0·06-0·07 „
„ diameter at mouth...	0·17-0·18 „
„ „ base ...	0·12-0·14 „

Locality.—Entangled amongst Polyzoa from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898.

HALECIUM SESSILE, *Norman.*

(Plate lxxxvii., figs. 8, 9.)

Halecium sessile, Norman, Rep. Brit. Assoc. Adv. Sci. for 1866, p. 196. *Id.*, Hincks, Hist. Brit. Hydroid Zoophytes, 1868, p. 229, pl. xliv., fig. 2. *Id.*, Billard, Ann. Sci. Nat., Zool., (8), xx., 1904, p. 157, pl. iii., figs. 8 and 9, pl. vi. *Id.*, Jäderholm, Kungl. Svenska Vetens-Akad. Handl., xlv., 1909, p. 58.

?Halecium robustum, Vanhöffen, Deutsche Südpolar Exp., 1901-1903, xi., Zool. iii., p. 319, fig. 35.

Station 54.

A rare colony or two, apparently of this species, was found springing from a stolon creeping upon a sandy worm-tube. The colonies are very minute, the largest being only 6 mm. high, in this respect resembling the dwarf variety described by Billard from La Hougue, which also grew upon the tubes of Sabellid

worms (or on *Cystosira*). No gonothecæ are present to confirm the identification, but the minute characters of the unfascicled and usually simple trophosome agree with those of this species. There is great variation, however, in the dimensions of the internodes, the proportions varying so much that little account ought to be taken of the relation of length to breadth in distinguishing at least this species. The following table of dimensions, as well as the figures on Plate lxxxvii., illustrate the variation which occurs even in the very scanty material before me.

Dimensions.—

Internode, length ..... 0·15, 0·27, 0·31, 0·57, 0·59 m.m.
„ diameter at base 0·14, 0·13, 0·14, 0·15, 0·14 „
Hydrotheca, diameter ..... 0·14 mm.

Locality.—On Sabellid worm tubes from Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand.

Halecium sessile, although widely distributed in the North Atlantic from Europe to the east coast of North America, and from Lofoten in Norway to south of Maderia, has not so far been recorded from without that area.

Family CAMPANULARIDÆ.

CAMPANULARIA HINCKSII, *Alder*,

var. GRANDIS, *Billard.*

Campanularia volubilis, var., Hincks, Ann. Mag. Nat. Hist. (2), xi., 1853, p. 180.

Campanularia hincksii, Alder, Ann. Mag. Nat. Hist. (2), xviii., 1856, p. 360, pl. xiii., fig. 9. *Id.*, Hincks, Hist. Brit. Hydroid Zoophytes, 1868, p. 162, fig. 18, pl. xxiv., figs. 3, 3*a*. *Id.*, Billard, Exp. Sci. "Travailleur" et "Talisman," Hydroides, viii., 1907, p. 172, fig. 4.

Campanularia hincksii, var. *grandis*, Billard, *Op. cit.*, p. 172, fig. 5.

Campanularia hincksi, Jäderholm, Kungl. Svenska Vetens.-Akad. Handl., xlv., 1909, p. 67, pl. vi., fig. 11.

Station 44.

The few specimens referred to this species differ somewhat from the typical forms of British seas. The main differences lie in the greater size of the Australian specimens; in the absence of longitudinal fluting on the walls of the hydrotheca; in the weakness or absence of the notch which in typical specimens

indents the square tops of the teeth; and in the shape of the hydrotheca, which, instead of forming a cylinder rounded at the base, resembles more an inverted cone, for the sides slope gradually from the mouth where the diameter is greatest to the point of junction with the stalk. In these respects, as well as in the less marked development of the diaphragm at the base of the hydrotheca, our specimens agree with var. *grandis*, obtained by the "Talisman" in the Gulf of Cadiz, and described by Billard, and to that variety we accordingly assign them.

Dimensions.—

Stalk, length	up to 3·5 mm.
,, diameter	0·057-0·096 mm.
Hydrotheca, depth.....	0·91-0·98 mm.
,, diameter at mouth ...	0·38-0·49 mm.

Remarks.—*Campanularia hincksii*, var. *grandis*, is a variety which approaches the Antarctic species, *Campanularia laevis*, originally described by Hartlaub. The dimensions of the latter, however, are gigantic compared with those of this Australian form.

Localities.—Growing on *Sertularella divaricata*, var. *subdichotoma*, from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898—rare. Also on a Polyzoon (without Station number), New South Wales.

Campanularia hincksii has been recorded frequently from the eastern waters of the North Atlantic Ocean, from Norway to the south of Madeira; less frequently from the western portion of the North Atlantic (by Verrill and Nutting), while records by Torrey alone tell of its presence on the west of North America. Broch says of it:—"Die Art scheint ihre Hauptverbreitung in den subarktischen Teilen des Atlantischen Ozeans zu haben."[5] So far as I am aware, the species has not hitherto been recorded from the Southern Hemisphere.

CAMPANULARIA TINCTA, *Hincks* (?).

Campanularia tincta, Hincks, Ann. Mag. Nat. Hist. (3), vii., 1861, p. 280, pl. xii. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 57, pl. i., figs. 4-6. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 337, fig. 18. *Id.*, Vanhöffen, Deutsche Südpolar Exped., 1901-1903, xi., Zool. iii., Hydroiden, p. 296, fig. 17.

[5] Broch—Die Hydroiden der arktischen Meere—in Fauna Arctica, v., Jena, 1909, p. 225.

Hincksia tincta, L. Agassiz, Cont. Nat. Hist. U.S. (2), iv., p. 355.

Stations 36 and 54.

The specimens I have referred to this species possess no trace of gonosome. Although the characters of the trophosome agree with those of this species as described by authors, and especially with those of specimens described by Dr. Warren from Natal, there is so great a similarity between this trophosome and that of typical examples of *Campanularia volubilis* (Linn.), that, in the absence of the gonangium, I hesitate definitely to decide. These specimens, while they vary considerably as regards the character of the peduncle, generally show more definite undulations or twistings than most authors describe, these reaching in some cases even to the base; in this respect they resemble Warren's specimens. The teeth of a hydrotheca vary in number from eleven to thirteen.

Dimensions.—

Peduncle, length	0·35-1·22 mm.
,, diameter	0·05-0·07 mm.
Hydrotheca, depth	0·35-0·42 mm.
,, diameter at mouth	0·18-0·28 mm.

The dimensions of parts agree sufficiently closely with those calculated from Hincks' figure, and with those given by Warren, but they are much smaller than Bale's figures imply, and they are also considerably smaller than Vanhöffen's specimens from the Antarctic, and than specimens I have recorded from the Falkland Islands.

Localities.—Growing on *Sertularella adpressa* from Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898. Also growing on *Thuiaria sinuosa* from Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898.

Previous Australian records are:—Australia, "collected in the neighbourhood of Melbourne and Geelong" (Hincks); Port Phillip and Portland (Bale).

CLYTIA ELONGATA, *Marktanner-Turneretscher*.

?*Clytia elongata*, Marktanner-Turneretscher, Ann. K.K. Hof.-mus. Wien, v., 1890, p. 215, pl. iii., fig. 11.

Clytia elongata, Warren, Ann. Natal Govt. Mus., i., 1908, p. 339, text fig. 20.

Creeping on a Polyzoon is a stolon from which spring rare simple Campanularian stems. The stems are as a rule comparatively short, for they frequently scarcely exceed the length of the hydrotheca. A variable number of rings mark the top and base

of the stem, three or four being most common, while the intermediate portion is smooth, or bears a set of fairly definite rings, or is indefinitely corrugated after the manner of the stem of the common European *Campanularia volubilis*. Upon the stems are placed firmly the exceedingly long and slender hydrothecæ, four times as long as broad, almost cylindrical in shape, but in the proximal half tapering gradually to the base. A weakly developed diaphragm surrounds the wall a short distance from the base and the margin is cut into ten or eleven long but rounded teeth, which are separated by deep, semicircular embayments. Rarely the margin of a hydrotheca is duplicated.

Scarcely a trace of cœnosarc remained, and no gonosome was present.

Dimensions.—

Stolon, diameter	0·04-0·06	mm.
Stalk, length	0·38-1·17	„
„ diameter	0·048-0·06	„
Hydrotheca, length	0·66-0·87	„
„ diameter at mouth	0·19-0·25	„

Remarks.—These specimens are without doubt identical with Marktanner's specimens, from which they differ only in having somewhat larger hydrothecæ, with ten or eleven instead of twelve teeth. On the other hand, they are smaller than Warren's specimens, and differ moreover in having the ringing of the stem less definite, and in lacking a "terminal small spherule." The possession of such a spherule may on occasion be a good specific character, but the fact that in Warren's examples it is "very variable in size," and can scarcely be distinguished in his figures, seems to show that its occurrence there is scarcely so significant.

That Warren, ignorant of Marktanner's species, should have elected to call his specimens *elongata* also, is a coincidence witnessing to the distinctive character which rests in the long, narrow hydrothecæ.

Locality.—Creeping on a Polyzoon, from off the coast of New South Wales; March, 1898; very rare.

The species is new to the fauna of Australia. Previous records are from Auckland, New Zealand (Marktanner), and Bird Island, Algoa Bay, 40 fathoms (Warren).

HEBELLA CALCARATA (*A. Agassiz*).

Lafoëa calcarata, A. Agassiz, Mem. Mus. Comp. Zool. Harvard, i., 1865, p. 122, fig. 190. *Id.*, Billard, Exped. Sci. "Travailleur" et "Talisman," viii., 1907, p. 174.

Lafoëa cylindrica, Von Lendenfeld, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 912, pl. xl., figs. 4, 5.

Lafoëa scandens, Bale, Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 758, pl. xiii., figs. 16-19. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 341, fig. 21.

Hebella cylindrata, Marktanner-Turneretscher, Ann. K.K. Hofmus. Wien, v., 1890, p. 214, pl. iii., fig. 15.

Hebella contorta, Marktanner-Turneretscher, *Op. cit.*, p. 215, pl. iii., fig. 17.

Hebella cylindrica, Pictet, Rev. Suisse Zool., i., 1893, p. 41, pl. ii., fig. 36.

Hebella calcarata, Nutting, Bull. U.S. Fish. Comm., xix., 1901, p. 353, fig. 56.

Stations 10, 36, and 44.

Localities.—Common on *Synthecium orthogonium* from Station 10, off Broken Head, two to four and a half miles from shore; depth, 28 fathoms; bottom, fine sand; 22nd Feb., 1898.

Rare on *Sertularella adpressa* and *Synthecium orthogonium* from Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898.

Rare on Polyzoon from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898.

Family LAFOËIDÆ.

LAFOËA GRACILLIMA, *Alder*.

Forma *typica*.

Campanularia gracillima, Alder, Trans. Tynes. Nat. F. Club iii., 1857, p. 39, pl. vi., figs. 5, 6.

Lafoëa fruticosa, Hincks (in part), Hist. Brit. Hydroid Zoophytes, 1868, p. 202, pl. xli., fig. 2. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 64, pl. ii., fig. 1.

Lafoëa gracillima, G. O. Sars, Forhandl. Vidensk. Selsk. Kristiania, 1873, p 27, pl. iv., figs. 19-21. *Id.*, Bonnevie, Norwegian North Atlantic Expedition, 1876-78, Zool., Hydroida, 1899, p. 65, pl. v., fig. 2*a*. *Id.*, Jäderholm, Kungl. Svenska Vetens.-Akad. Handl., xlv., 1909. p. 74, pl. vii., figs. 6-8. *Id.*, Broch, Die Hydroiden der arktischen Meere in Fauna Arctica, v., 1909, p. 156, figs. 17, 18.

Station 34.

Small colonies belonging, without doubt, to this widely distributed species, occur growing upon a straggling Polyzoon. The colonies cannot compare in size with the well-developed examples found in the North Sea, for they are less than 1 cm. high, but as regards fasciculation, irregular arrangement of hydrothecæ, and details of hydrothecal shape, they are in perfect agreement with European specimens of forma *typica*. The stalk of the hydrotheca is marked by only a single loose twist, and, of the many variations figured by Broch, the hydrothecæ almost exactly resemble those of specimens of the typical form from the mouth of the Christiania Fjord (Broch, 1909, fig. 17, v., p. 157.)

Dimensions.—

Stem tube, diameter	0·08-0·12 mm.
Hydrotheca, length[6]	0·52-0·63 ,,
,, diameter at mouth	0·139-0·147 ,,

These measurements show that the parts of the Australian specimens are smaller than those of Mediterranean examples recorded by Billard[7] from south-west of Toulon, although they agree with those of North Sea specimens in my collection.

Locality —Station 34, off Port Jackson, three and a half to two and a half miles from shore; 39 to 36 fathoms; bottom, sand and mud; 10th March, 1898.

Only a single previous record of this species has been made from Australian waters, Hincks, (1868, p. 203) mentioning a specimen from Bass Strait as being with "little doubt" identical with *Lafoëa fruticosa*. Bale, in his "Catalogue," has followed him in this mistaken synonymy.

LAFOËA SERRATA, *Clarke.*

Lafoëa serrata, Clarke, Bull. Mus. Comp. Zool. Harvard, v., 1879, p. 242, pl. iv., fig. 25. *Id.*, Thornely in Herdman, Ceylon 'Pearl Fisheries, pt. ii, Suppl. Rep. viii., Hydroida, 1904, p. 116. *Id.*, Hartlaub, Zool. Jahrb. Jena, Suppl. 6, iii., 1905, p. 595, fig. Q[2]. *Id.*, Billard, (1) Exped. Sci. "Talisman" et "Travailleur," viii., 1907, p. 178, and (2) Arch. Zool. exper., vii., 1907, p. 340. *Id.*, Ritchie, (1) Rec. Indian Mus., v., pt. 1, 1910, p. 9, and (2) Proc. Zool. Soc., 1910, 2, p. 815.

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[6] Including stalk.

[7] Billard—Exped. Sci. "Travailleur" et "Talisman," viii., 1907, Hydroides, p. 176.

Stations 44, 47, 48, and 54.

Specimens of this widely distributed epizoic species occur on several hosts from several stations. The abundance of the hydrothecæ which bristle upon the weathered axis of an Isid Alcyonarian from Station 47 is specially remarkable, the growth resembling that of *Lafoëa contorta*, Nutting, from Hawaii, which differs from the present species only in the fact that annular thickenings of the hydrothecal wall are absent from the adnate portion, yet in Nutting's figures[8] striations are shown on some of the hydrothecæ. There is much variation in the relative proportions of adnate and free portions, this being in the main due to extensions to which the free portion is liable by the addition of new margins. As many as six repetitions may occur, more than doubling the length of the free portion. In the following table of dimensions, therefore, I give, as being more constant, the length of the primary hydrotheca of the repeated series. There is also much variation in the distinctness of the striations which occur on the horizontal portion; for while these are well marked in some specimens, in others, they are almost invisible, and the latter are hard to distinguish from hydrothecæ of *Filellum serpens*, on which also faint striations sometimes occur.

Gonosome.—The gonosome, of which I have seen no description, is aggregated in coppinia form, an elongated cluster surrounding the surface upon which the colonies are creeping The essential part of the structure is very similar to that of *Filellum serpens*, the gonangia appearing in surface view as close-set irregular polygons, each with a slightly raised circular aperture. Between these in one case project long tubes, which stand out stiffly from the surface of the coppinia, unlike the curling, close-lying individuals of *F. serpens*. In the only other example I have seen, the tubes do not project, but instead lie closely apposed to each other, parallel to the surface of the coppinia. In cross section, these tubes are almost rectangular, for they are compressed in a direction at right angles to the surface of the coppinia. Thus the coppinia is enclosed in an irregular double-walled case formed of close-set, adnate tubes, and having a distant resemblance to a structure of basket-work.

In cross section of the coppinia there was seen, surrounding the Alcyonarian axis upon which the colony was creeping, an irregular layer of tubes of small calibre, oval in cross section, their long axis parallel to the surface of the substratum. These correspond to the network of tubes which forms the rhizoidal structure of the colony in general. From them arise radially long strong-walled gonangial tubes which sometimes at least (as

[8] Nutting—Bull. U.S. Fish Comm. for 1903, pt. iii., 1905, pl. ix., figs. 8, 9, p. 945.

in the case described above) form a protection for the aggregated gonangia and their contents.

The dimensions of the specimens agree most closely with those of specimens recorded by Billard ([2], 1907, p. 179) as a variety of the species. The wide range of variation to which the species is liable, as the following measurements illustrate, renders unlikely the supposition of Billard that his large variety may belong to a new species.

Dimensions.—

Hydranth, length of adnate portion..... 0·28-0·51mm.
„ „ „ free „ (primary hydrotheca) 0·21-0·33 „
„ total length of free portion up to 0·52 „
„ diameter at mouth..... 0·12-0·14 „

Localities.—Rare on Polyzoon from Station 44, off Coogee, five to six miles from shore ; depth, 49-50 fathoms ; bottom, fine sand ; 15th March, 1898. Abundant on bare axis of an Isid Alcyonarian, and rare on the stem of *Aglaophenia cruciulis* from Station 47, off Bulgo, six to eight and a half miles from shore ; depth, 63 to 57 fathoms ; bottom, mud and abattoir refuse ; 16th March, 1898. Rare specimens on *Halicornaria furcata* from Station 48, off Wollongong, seven to eight miles from shore ; depth, 55 to 56 fathoms ; bottom, sand and mud to rock ; 18th March, 1898. Station 54, within Jervis Bay ; depth, 10 to 11 fathoms ; bottom, seaweed and sand ; 20th March, 1898 ; rare on rhizoidal tubes of *Diphasia subcarinata.*

LAFOËA TENELLULA, *Allman.*

(Plate lxxxviii., fig. 5.)

Lafoëa tenellula, Allman, Mem. Mus. Comp. Zool. Harvard, v., no. 2, 1877, p. 12, pl. viii., figs. 3, 4.

Station 57.

The specimens which I refer to this species are meandering over the branches of a *Hippothoa*-like Polyzoon. They consist of simple creeping stolons from which, at long, irregular intervals, hydrothecæ spring. The hydrothecæ are very long, and are almost cylindrical in shape, the cylinder, however, being slightly bent at the middle. On one side of the base there is a slight bulge, and it is generally towards this side that the upper portion of the hydrotheca is inclined. The base of the hydrotheca cavity is separated from that of the peduncle by an exceedingly delicate diaphragm, the hydranth having been attached at this

point to minute knobs of chitin which form a ring on the inner surface of the hydrotheca. The aperture of the hydrotheca is circular, the margin entire, set at a slight angle to the axis of the hydrotheca, not everted, but almost always repeated twice or thrice, owing to the successive regeneration of hydranths. The walls of the hydrotheca are colourless and delicate. The hydrotheca narrows gradually to the base and passes imperceptibly into the peduncle. This is of comparatively wide diameter, is about one-third as long as the hydrotheca, although there is much variation, and is always marked by only a single strong constriction which occurs very near its junction with the stolon. Scarcely a trace of the hydranths remained, and there was no trace of the gonosome.

Dimensions.—

Stolon, diameter	0·042 mm.
Hydrotheca, length to diaphragm	0·34-0·39 mm.
,, diameter	0·09-0·10 ,,
Peduncle, length	0·07-0·15 ,,
,, diameter	0·039 mm.

Systematic Position.—These Australian specimens agree with the very short and scrappy description and with the figure by Allman, except in a single point, that the peduncle is marked by a definite constriction of which there is no sign in the American examples. The hydrothecæ, except for this constriction, much resemble those of *Lafoëa dumosa*, but that species is twice as large, of less elegant build, with more dumpy peduncles, and is much stronger and coarser in appearance.

The species is *Hebella*-like, but until the gonosome has been discovered, it would be rash to remove it from the genus in which it was placed by Allman.

Locality.—Growing upon a Polyzoon from Station 57, off Wata Mooli, three and a half to four miles from the shore; depth, 59 to 54 fathoms; bottom, mud; 22nd March, 1898.

I am aware of no previous record, other than that given by Allman—south of Marquesas, Florida, United States, 140 fathoms. The extension of range from the western shore of the tropical Atlantic to the southern Pacific is remarkable.

LICTORELLA ANTIPATHES (*Lamarck*).

Sertularia antipathes, Lamarck, Hist. nat. Anim. sans Vertèbres 1816, p. 115.

Laomedea antipathes, Lamouroux, Hist. polyp. corral. fléxibles, 1816, p. 206, pl. vi., figs. 1*a*, B.

Campanularia rufa, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 54, pl. i., fig. 1.

Lictorella halecioides, Allman, 1888 (but not *Lafoëa halecioides*, 1874), Sci. Res. Rep. "Challenger" Exped., Zool. xxiii., Hydroida, Part ii., p. 35, pl. xvii., figs. 1, 2. *Id.*, Kirkpatrick, Sci. Proc. Roy. Dublin Soc. (n.s.), vi., 1890, p. 608.

Lictorella antipathes, Billard, Ann. Sci. Nat., Zool., (9), vi., 1907, p. 216, fig. 1; *Id.*, Billard, *Op. cit.*, (9), ix., 1909, p. 312; *Id.*, Billard, *Op. cit.*, (9), xi., 1910, p. 6, fig. 1.

Stations 34 and 40.

Many specimens of this species were obtained. Although they are much broken, the robustness of the stems, one of which is 5 mm. in diameter immediately above the basal attachment, indicates that some of the colonies must have exceeded by far the height of four inches given by Allman. The colours of the perisarc are unusual, the stems and branches, and even the ultimate twigs appearing black, the hydrothecæ dark brown. "Joints," due to the destruction and regeneration of successive hydrothecæ, are frequent on the peduncles of the hydrothecæ.

Dimensions.—

Ultimate twigs, diameter	0·11-0·15 mm.
,, ,, distance between hydrothecæ...	0·49-0·67 ,,
Hydrotheca,[9] length (margin to internode process)	0·42-0·48 ,,
,, diameter at mouth	0·18-0·21 ,,

These measurements are somewhat larger than Billard's (1907, p. 216) measurements of Lamarck's type specimen, but they agree with the same author's measurements of the "Challenger" *Lafoëa halecioides* (1910, p. 6).

Remarks.—Comparison of the present specimens, identical with the *Lictorella halecioides* of the "Challenger" Report (see Billard, 1910), with specimens of *Lictorella pinnata* from Lat. 60° 6′ N., 8° 14′ W., in the neighbourhood where Allman's type specimens of *Lafoëa halecioides* were obtained, confirms E. T. Browne's[10] surmise that Allman was mistaken in identifying the Australian *Lictorella* with that which he had previously obtained in the North Atlantic. That is to say, *Lictorella pinnata* (Sars), (*Lafoëa halecioides* of "Porcupine" Report), is distinct from *Lictorella antipathes* (Lamarck), (*Lafoëa halecioides* of "Challenger" Report). I have not been able to distinguish on the fragment of a Faroe Channel specimen in my possession

[9] The dimensions of the primary hydrotheca are given, reduplicated margins, which may add 0·1 mm. to the length, being omitted.

[10] Browne—Journ. Mar. Biol. Assoc. Plymouth, viii., 1907, p. 26.

the "very minute pedunculated cups" which Browne found on his specimen from the Bay of Biscay, and which would make necessary the transference of the latter to the genus *Zygophylax*.

Localities.—Station 34, three and a half to two and a half miles off Port Jackson; depth, 39 to 36 fathoms, sand and mud; many colonies. Station 40, three miles off Wata Mooli; depth, 52 fathoms, sand and boulders; few fragments.

LICTORELLA CONCINNA,[11] *sp. nov.*

(Plate lxxxviii., figs. 3, 4.)

Station 44.

This species has been created for a very small number of colonies which were found at Station 44.

Trophosome.—The largest colony, which is not quite complete, is 25 mm. high. It consists of an axial tube surrounded by a few fascicular tubes which accompany the stem, but occur only on the largest of the branches. On the axial tube are borne hydrothecæ and branches. The latter are pinnately arranged, are subalternate, lie in one plane, and appear to be in pairs, each pair being separated by twice the distance which intervenes between the members of a pair. Approximately, two hydrothecæ spring from the stem between two pairs of branches, while between the branches of a pair only one is present. The stem shows no traces of division into internodes, but it bears alternate hydrothecæ at regular intervals even to the base. The branches are generally simple and monosiphonic, but rarely there occurs a larger individual, slightly fascicled, and bearing pinnate branches like the stem. All the branches are delicate and elegant, are slightly sinuous, as is the axial tube of the stem, and bear at each bend a hydrotheca. There are no regular nodes, though a rare one occasionally appears half way between two hydrothecæ.

The hydrothecæ are very graceful structures. They lie in one plane, and arise alternately from opposite sides of the stem and branches. One is always present at the base of a branch, close to, but not quite in the angle formed between branch and stem. Each hydrotheca rests on a well-marked projection from stem or branch. On this is perched a long cylindrical stalk, slightly constricted at the base, and widening at its upper extremity into the hydrotheca. The stalk is half or a little more than half the length of the hydrotheca. The hydrothecæ are deep, tubular, and cyathiform, the abcauline profile forming a simple convex curve, the adcauline a compound curve, first convex, then concave.

[11] *Concinnus*, neat, elegant.

They project upwards and outwards from the stem at an angle varying about 45°. The aperture is round and smooth-lipped, and is, along with the distal part of the hydrotheca, turned upwards so that it lies obliquely to the axis of the hydrotheca. This angularity is increased by the occurrence of additional regenerated margins which are frequently present. The upward bending of its extremity gives to the hydrotheca a peculiar asymmetrical appearance which occurs in but few species. A well-defined diaphragm separates a hydrotheca from its stalk.

Gonosome.—Not present.

Dimensions.—

Height of colony	10 mm.
Axial tube, diameter	0·11 mm.
Branch, diameter	0·07-0·08 mm.
Hydrotheca, length ..... --	0·24-0·31 „
„ diameter at mouth ..	0·10-0·11 „
Stalk, length.....	0·13-0·22 „

Remarks.—The present species closely approaches *Lafoëa convallaria*, Allman, but here the habit of the hydrotheca is more rigid; the curving of the pedicles does not occur; that of the hydrotheca is less exaggerated; and the hydrothecæ themselves are more tubular and less flask-shaped. The trophosome of *Lictorella concinna* exactly resembles that of *L. cervicornis*, Nutting, with the exception that in the former nematophores are entirely absent. So remarkable is the resemblance between the two species that I have repeatedly, but in vain, made search for traces of nematophores, thinking that I might have previously overlooked them. Without evidence that the presence or absence of such structures falls within the range of everyday variation, I must consider their absence significant. The presence of these structures would, in the classification usually adopted, give Nutting's species the designation *Zygophylax cervicornis* (Nutting).

Locality.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898. Very rare.

Type Specimens.—In the Australian Museum, Sydney.

CRYPTOLARIA ARBORIFORMIS[12], *sp. nov.*

(Plate lxxxiv., fig. 1; Plate lxxxvii., fig. 7.)

Station 44.

Trophosome.—A single robust colony, 15 cms. high, with thick gnarled stem, 5 mm. in diameter at the base, which immediately

[12] *Arbor* a tree; *formis* implying resemblance in shape.

divides into several stout branches, one of which anastomoses later with the stem. From the stem spring branches, large and small, with indescribable irregularity. Irregular offshoots spring from these to the fourth degree. All the branches are of the same character as the stem, bearing the aspect of bare, gnarled limbs of some weather-beaten tree. All, like the stem, are strongly fascicled, and from most the ultimate, more delicate branchlets, on which the hydrothecæ are exposed, have disappeared. Where ultimate branchlets occur, they are seen to lie in one plane and to spring in pinnate fashion from the branches, those on one side lying almost opposite those on the other. The ultimate branches are incomplete, and the whole colony appears to have undergone severe weathering, but in the portions which exist, fascicle tubes accompany the axial tube through its whole length. The fascicular tubes are narrow with thick brown walls, perforated by large circular openings, which allow communication between the cavities of adjacent tubes. They generally run in close parallel courses, aggregates of many tubes, which entirely obscure the axial tube and its appendages; but at places, the tubes lose their regularity and twist, double, and branch, forming a knotted maze which appears as a slight swelling on the branch. Whether this contorted structure is a mere frolic of growth, or whether it has special purpose, the entire absence of even a trace of cœnosarc renders it impossible to say.

The axial tube is not divided into internodes, but it bears alternate hydrothecæ at regular intervals. These lie in one plane, and are somewhat close-set, the base of one hydrotheca lying opposite the summit of its predecessor.

The hydrothecæ are smaller and less graceful than is usual in this genus. They are somewhat short and dumpy, two and a half times as long as broad, narrow at base, widening upwards, and contracting slightly again at the mouth. They are adnate to the axial tube for almost the whole of their length, only a small portion projecting beyond the profile of the branch, even where fascicle tubes are few in number. The aperture is round, but is difficult to observe, as the margin is usually damaged; there are no signs of reduplication of margin. The hydrothecæ bend outwards from the stem in a gradual curve, so that the axis of the terminal portion of the hydrotheca faces upwards and away from the branch at an angle of about 50°, but the curve is stiff and lacks the finish and grace which characterises the hydrothecæ of the other species in this collection. No diaphragm occurs at the base of the hydrotheca, the cavity of which opens unrestricted into that of the axial tube; but the free end of the adcauline wall, which has been gradually sloping towards the

abcauline, here bends suddenly towards the interior of the hydrotheca, forming a narrow ledge at its base. *Gonosome.*—unknown.

Dimensions.—

Colony, height	15 cms.
Stem, diameter at base	5 mm.
Fascicle tube, diameter	0·08 mm.
Hydrotheca, length of adnate portion	0·28-0·31 ,,
,, ,, ,, free portion	0·08-0·11 ,,
,, greatest diameter	0·10-0·12 ,,

It is difficult to decide to which of the older species of the genus *Cryptolaria arboriformis* is most closely related; for its gnarled, tree-like habit, and its dumpy hydrothecæ, almost altogether adnate, with their cavity cut off from that of the axial tube by an inturned ledge, distinguish it from every other species.

Locality.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898.

Type Specimens.—In the Australian Museum, Sydney.

CRYPTOLARIA CONFERTA, *Allman*,

var. AUSTRALIS, *var. nov.*

(Plate lxxxiv., fig. 2; Plate lxxxvii., fig. 1.)

Cryptolaria conferta, Allman, Mem. Mus. Comp. Zool. Harvard, v., 1877, p. 17, pl. xii., figs. 6-10. *Id.*, Clarke, Bull. Mus. Comp. Zool., v., 1879, p. 244, pl. iii., figs. 14-20. *Id.*, Campenhausen, Abh. Senck. Ges. Frankfurt, xxiii., 1896, p. 309. *Id.*, Versluys, Mem. Soc. Zool. France, xii., 1899, p. 32. *Id.*, Pictet and Bedot, Res. Camp. Sci. Monaco, fasc. xviii., 1900, Hydraires, p. 17, pl. ii., fig. 3, pl. iii., fig. 7.

Lafoëa conferta, Billard, Exp. Sci. "Travailleur" et "Talisman," viii., 1907, Hydroïdes, p. 177.

Stations 40 and 42.

Trophosome.—The stems of the colonies are flexible and straight, the largest about 8 cms. high, yet scarcely one millimetre in diameter at the base. From base upwards the stem bears pinnate branches of finer texture than itself, and these occur at regular intervals from each other, a distance of 3 mm. separating two on the same side; while those on the opposite side alternate, and both series lie in one plane. The pinnæ are generally simple, from 1 to 2 cm. long, but they are frequently replaced by long

slender branches, up to 5 cm. in length, which in all respects, except robustness, resemble the stem, bearing pinnate branchlets to the third degree. Stem, pinnæ, and branches are fascicled, although a considerable portion of each termination remains free. Many of these pinnate colonies grow in association, and as their connection is secured by abundant anastomosis, a flabellate mass 15 cm. in breadth may be created.

The minute characters agree with the description of *Cryptolaria conferta* by Allman, amended by later observers. The hydrothecæ are long and slender, having, as a rule, about one-third of their length free. They are regularly alternate and are close-set, the base of one hydrotheca lying opposite the point where the preceding hydrotheca becomes free from the stem. They are cylindrical for the greater part, but narrow slightly towards the base, the diameter of the adnate portion equalling that of the axial tube at the same level. The inner wall of the hydrotheca ends abruptly with a slightly thickened knob, and the "distinct floor" of the hydrotheca, which Allman describes and figures, is absent, as Clarke noted in specimens of *Cryptolaria conferta* from the Gulf of Mexico, Versluys in Testigos Islands specimens, and as Campenhausen found, exceptionally, in examples of the same species from Ternate. The hydrotheca curves gradually and gracefully outwards from base to termination, and its round, smooth aperture varies from a position parallel to the long axis of the branch to an upwards inclination of 30°. The latter position is the more usual, however, for the former is brought about only by the unequal growth of repeated fresh margins, of which sometimes as many as eleven are present. In these specimens perforations connect the cavities of the peripheral with those of the axial tubes, though I am unable to confirm the existence of the regular arrangement which Clarke claimed for them.

As the hydranth of *Cryptolaria* remains undescribed, except for an observation on that of *Cryptolaria operculata* which I have recently recorded,[13] I do not hesitate to add a note on the rather poorly preserved hydranths of *Cryptolaria conferta* before me, notwithstanding that those of the following species are more fully described. In the state of contraction in which all are, they appear as elongate cylindrical bodies with seven to nine short tentacles surrounding a low, dome-shaped hypostome. The ectoderm is thin throughout, but elongated endoderm cells project into the digestive cavity beneath the level of the bases of the tentacles. The hydranth narrows somewhat proximally, and is terminated by a wider cœnosarcal disc which is attached to the

[13] Ritchie—Rec. Indian Mus., v., 1910, p. 10.

wall of the hydrotheca by short strands affixed to minute chitinous projections on the interior of the perisarc, a considerable distance above the apparent "base" of the hydrotheca. The occasional occurrence of several series of the bright dots which represent the projections, tells, as do repeated margins, of successive generations of hydranths.

Gonosome.—Not represented.

Dimensions.—

Hydrotheca,	length of adnate portion...	0·49-0·56 mm.
,,	length of free portion.....	0·22-0·32 ,,
,,	diameter at base.....	0·08-0·096 ,,
,,	diameter at mouth.....	0·11-0·12 ,,

Systematic Consideration.—Allman in his "Challenger" Memoir on the Hydroida (Pt. ii., p. 39) admits, as will anyone who has paid attention to the genus, that there is "comparatively little to rely on" in distinguishing the species of *Cryptolaria*. In such case, he has laid special stress upon the differences in the form of the ramification, but even this, he allows, "varies within very narrow limits." In the "Challenger" Report, almost all the species are primarily distinguished by their ramification—a character liable to much variation induced by environment. I am of opinion that, separated from minute structural distinctness, differences of habit cannot in general be considered specific, and therefore I regard the present regularly pinnate, flabelliform colonies, which in the main differ from typical *Cryptolaria conferta* only in their habit, as belonging to that species. But, indeed, Billard (1907, p. 178) has already noted that, in specimens from the Bay of Biscay, from off Cape Spartel, Morocco and the Soudan, pinnate ramification prevailed. The minute structure and proportions of the hydrothecæ of the Australian specimens are similar to those described and figured for *Cryptolaria conferta*, although the mouth diameter is a little smaller than that of Allman's type specimens, judging by the magnified figure of the latter given by Clarke in which the mouth is represented as being 0·16 mm. broad. The remaining dimensions agree with the type and with Billard's measurements.

Pictet and Bedot (1900, p. 19), as also Hartlaub (1904, p. 13), and Browne[14] express the opinion that *Cryptolaria crassicaulis*, Allman, 1888, is synonymous with *Cryptolaria conferta*, Allman, 1877. After examination of portion of the type specimen of the former, I must differ from those authors.[15] Apart altogether from the habit of the colonies, an uncertain and untrustworthy character, sufficient specific difference lies in the minute structure

[14] Browne—Journ. Mar. Biol. Assoc. Plymouth, viii., 1907, p. 29.

[15] See Plate lxxxvii., fig. 4.

of the hydrotheca. Examination of the following table indicates a marked difference in size and proportions :—

	Cryptolaria conferta.			Cryptolaria crassicaulis.	
	Type from Clarke's figures.[16]	Billard's specimens.	Present specimens.	From Hartlaub's fig. of *C. conferta*.[16]	Allman's type.[17]
Hydrotheca, length of adnate portion...	0·6	0·35-0·50	0·49-0·56	1·0	0·92-0·98
Hydrotheca, length of free portion	0·3	0·26-0·385	0·22-0·32	0·70	0·52-0·83
Hydrotheca, diameter at base	0·1	?	0·08-0·096	0·08	0·08-0·11
Hydrotheca, diameter at mouth	0·16	0·14-0·16	0·11-0·12	0·26	0·29-0·35

Measurements are in millimetres.

These differences are visible, firstly in the very much larger size of the hydrothecæ of *Cryptolaria crassicaulis*, and, secondly, in the shape of the hydrotheca ; for while those of *C. crassicaulis* are four times as wide at the mouth as at the base, those of *C. conferta* are only one and a half times. The greater narrowing emphasises the tapering of the hydrothecæ in *C. crassicaulis* and produces a cornucopia appearance, distinct from the almost cylindrical shape of the hydrothecæ of *C. conferta*. In the specimens before me there is also a great difference in the robustness of the perisarc, which is more strongly developed in *C. conferta* (the smaller in dimensions) than in *C. crassicaulis*, as the following measurements indicate. But differences in thickness of perisarc are frequently of no significance specifically.

	C. conferta.	*C. crassicaulis*.
Thickness of outer wall of hydrotheca	12-22μ ...	9-15μ
Thickness of adnate wall of hydrotheca at base	14-27μ ...	11-15μ
Thickness of general perisarc	15-24μ ...	9-19μ

I am of opinion, judging from the size and shape of the hydrothecæ, that the specimens doubtfully recorded by Hartlaub from

[16] These measurements, estimated from magnified figures, must be taken as approximate only.

[17] See Plate lxxxvii., fig. 4.

Antarctic Seas as *Cryptolaria conferta*, Allman(?),[18] the dimensions of which are given above, belongs not to that species but to *C. crassicaulis*.

The resemblance of the habit of these Australian specimens to that of *Cryptolaria pulchella* led me to examine Allman's type of the latter, a fragment of which was kindly lent me by Mr. R. Kirkpatrick, of the British Museum. Allman's figures of this species in the "Challenger" Reports are utterly misleading, for they indicate a tubular hydrotheca of constant width throughout all its length, with a distinctly flaring margin. The fragment of Allman's type which I have examined, possessed hydrothecæ without flaring margins, wide at the mouth, and diminishing in calibre very markedly towards the base, where they are very narrow. The hydrothecæ, indeed, are similar in shape to those of *C. crassicaulis*, though they are less in size. They show that *C. pulchella* is distinct from *C. conferta*, var. *australis*.

Localities.—Station 40, off Wata Mooli, three miles from shore; depth, 52 fathoms; bottom, sand and boulders; 12th March, 1898. Several young colonies growing on a Polyzoon.—Station 42, off Wata Mooli, six to eight and a half miles from shore; depth, 70 to 78 fathoms; bottom, coarse sand; 13th March, 1898. Many fine colonies.

Distribution.—*Cryptolaria conferta* has been recorded from the Atlantic Ocean by several investigators; from the Gulf of Mexico and the West Indies to the Azores (Pictet and Bedot, 1900), and the Bay of Biscay (Billard, 1907; Browne, 1907). I am aware of only two records from the Pacific Ocean; from the Eastern Pacific—off the west coast of Central America (Clarke, 1894), and from the Western Pacific—from Ternate in the Molucca Islands (Campenhausen, 1896). The species is new to Australia Seas.

Type Specimens of variety.—In the Australian Museum, Sydney.

CRYPTOLARIA CRASSICAULIS, *Allman.*

var. DIMORPHA[19], *var. nov.*

(Plate lxxxvii., figs. 5, 6; *cf.* fig. 4.)

Cryptolaria crassicaulis, Allman, Rep. Sci. Res. "Challenger," Exped., Zool., xxiii., Hydroida, Part ii., 1888, p. 41, pl. xix., figs. 3, 3*a*.

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[18] Hartlaub—Voyage du S.Y. "Belgica," 1897-99, Zool., Hydroiden, 1904, p. 13, pl. ii., fig. 1.

[19] δίμορφος, of two forms.

Cryptolaria conferta ?, Hartlaub, Res. Voyage S.Y. "Belgica," 1897-99, Zool, Hydroiden, 1904, p. 13, pl. ii., fig. 1 (see above under *Cryptolaria conferta*).

Station 48.

A poor colony, 6 cms. high, with strong stem, and few branches arranged in approximately pinnate fashion, is the more typical representative of this species. The varietal name indicates, however, the existence of two distinct growth forms assumed by the colonies.

Form 1. *Trophosome.*—The habit of this form is more robust than that of the type of *Cryptolaria crassicaulis*, the hydrothecæ appearing larger even to the naked eye, and the ultimate branches less slender and flaccid. The hydrothecæ are distichous, regularly alternate, and close-set, the base of one lying on a level with the point where its predecessor becomes free. They are long and of large calibre, adnate for rather more than half their total length. Cylindrical for the greater part, they narrow markedly towards the base, the diameter of which is generally less than one-third that of the aperture ; yet the average diameter of the adnate portion is much greater than that of the axial tube at the same level. The hydrotheca-cavity passes without interruption into that of the axial tube, and a smaller perforation situated alongside the base of the hydrotheca gives passage to a strand of cœnosarc passing between the latter and the associated peripheral tube. The hydrothecæ curve gradually outwards, the apertures facing outwards and slightly upwards, while the profile of the axial tube follows the curved adcauline outline of the hydrotheca.

Form 2. *Trophosome.*—The hydrothecæ in the known species of *Cryptolaria* arise from an axial tube which is, for the most part, surrounded by peripheral tubes, and to this tube they are adnate for the greater portion of their length—except in some cases, where, under the peripheral tubes, they are free. In some unusual specimens before me, the axial tube, unencumbered by accessory tubes, has grown along a *Gemmelaria*-like polyzoon ; and, while giving rise in places to normal *Cryptolaria* branches, more frequently bears *solitary*, *free hydrothecæ* which were at first mistaken for examples approaching the smooth variety of *Hebella striata*, Allman. These hydrothecæ grow at right angles to the creeping stolon-like tube, and are almost straight, the marked curve of the adnate hydrothecæ being entirely lost. In this state, the narrowed base of the adnate hydrotheca is represented by a short peduncle supporting the free one. But except for the straightening, the shape of the two types of hydrotheca is similar, as are their dimensions and proportions.

The hydranths are attached to the hydrotheca some short distance above the free end of the internal wall, the level being marked by a slight constriction of the hydrotheca. Low prominences set in a ring stud the internal surface of the perisarc at this point, and to these a disk of cœnosarc at the base of the hydranth is attached. But beneath the attached basal disc, a second attachment occurs, for irregular strands of sarcode branch from the ectoderm immediately below the hydranth and are attached to the walls of the hydrotheca. A similar development occurs in *Laomedea geniculata*[20]. The hydranths are strongly contractile, and when fully withdrawn form a very short stout cylinder. Expanded, each consists of a long narrow cylindrical neck, surmounted by a fusiform "head," which terminates in a small sharply-conical hypostome. This is surrounded by a circle of sixteen or seventeen tentacles. As to minute structure—The tentacles consist of a moderately thick ectoderm which contains few nematocysts arranged in whorls, and of skeletal endoderm, the septa between the cells of which stretch across the interior of the tentacle. In the body-wall of the hydranth the ectoderm is comparatively thin, and it is lined by a thick endoderm composed of columnar cells which, especially beneath the hypostome, project far into the digestive cavity. *Gonosome* not present.

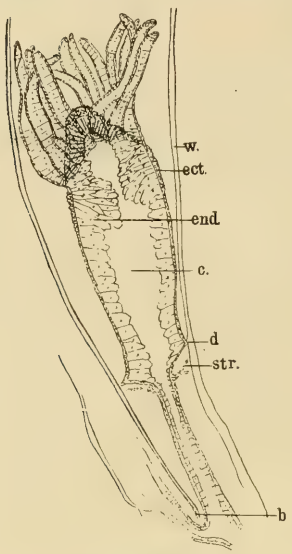

Fig. 126.

Hydranth of *Cryptolaria crassicaulis* var. *dimorpha* × 70; *w*, external wall of hydrotheca; *ect*, ectoderm; *end*, endoderm; *c*, cavity of hydranth; *d*, basal disc of attachment; *str*, supporting strands; *b*, base of internal wall of hydrotheca.

Dimensions.—

Organs.	Form 1. Adnate specimens.	Form 2. Free specimens.
Hydrotheca, length of adnate portion	0·88-1·01 mm.	1·54-1·59 mm.
,, length of free portion....	0·70-0·98 ,,	
,, diameter at base.....	0·14-0·18 ,,	0·14 mm.
,, ,, ,, mouth.....	0·38-0·52 ,,	0·35-0·40 mm.

[20] See Broch—Hydroiden: in Fauna Arctica, Jena, v., 1909, p. 183, fig. 38c.

Remarks.—The consideration of the relationship existing between the simple free form of this variety and its more typical form with adnate hydrothecæ throws some light on the probable origin of *Cryptolaria*. An example before me illustrates this. A single free hydrotheca is growing out from the creeping stolon. At the base of the hydrotheca the stolon, leaving the substratum, curves sharply round and having reached the stalk of the hydrotheca, clings to, and ascends this, and part of the hydrotheca as well. The hydrotheca appears now to be adnate, and the erstwhile stolon has become the axial tube. That the latter can assume its original character again is shown by the fact that the axial tube sometimes terminates as a stolon. The minute space which intervenes between the perisarc of the adnate hydrotheca and that of the axial tube at the base of the inner wall of the former, and the distinctness of the two skeletal layers, even where they are adnate, points also to the essential distinctness of hydrotheca and axial tube.

It would appear, then, that *Cryptolaria* has arisen from a simple *Lafoëa*-like stock by the union of a hydrorhizal tube along a hydrotheca to which it just has given rise—somewhat after the manner of the development of the rhizocaulon of *Lafoëa dumosa*. The regularity of the arrangement of the hydrothecæ, and of the branches and branchlets in *Cryptolaria*, points, however, to a growth less haphazard than that of the typical rhizocaulon. The close relationship between *Lafoëa* and *Cryptolaria* has already been clearly shown by the similarity of their coppiniagonosomes; the presence in one and the same species of two forms of individuals which, found separately, would have been classified as distinct species of *Lafoëa* and of *Cryptolaria*, emphasises as markedly this relationship. Yet, although Billard has already slumped these two genera under the name of the former, I prefer at present to keep them distinct, on account of the convenience to systematists which their separation into broadly marked groups gives, rather than on account of their natural apartness.

The reasons which lead me to consider Hartlaub's *Cryptolaria conferta*? as a synonym of *C. crassicaulis* are given above in the discussion regarding *C. conferta*.

Locality.—Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; a single colony.

Distribution.—*Cryptolaria crassicaulis* was described by Allman from specimens obtained off Ascension Island at a depth of 420 fathoms. Since then Hartlaub has described from Antarctic Seas (Lat. 70° 00′ S., Long. 80° 48′ W., 550 metres) under the name *Cryptolaria conferta*?, specimens which seem to me to belong to this species.

PERISIPHONIA EXSERTA (*Johnson*).

(Plate lxxxvii., fig. 3; *cf.* fig. 2.)

Cryptolaria exserta, J. V. Johnson, Quart. Journ. Micro. Sci., vi., 1858, p. 130, pl. xix., figs. 3, 3*a*, 3*b*.

Perisiphonia filicula, Allman, Rep. Sci. Res. "Challenger" Exped., Zool., xxiii., 1888, Hydroida, p. 44, pl. xxii., figs. 1-4.

Station 57.

Trophosome.—A single young colony, less than 20 mm. in height, alone represents this genus. The stem is slender and polysiphonate, with a fascicle of about ten to twelve peripheral tubes. From it arise slender branches or hydroclades, lying in one plane, in sub-opposite pairs which are 2-5 mm. apart. These attain a length of 10 mm. and are slightly fascicled. At the base, one or more peripheral tubes accompany the offshoot of the axial tube from the stem, and here the hydroclade is of very small diameter; additional tubes, which arise from the hydroclade itself, strengthen the fascicle and increase the diameter in the median part, although towards the tip the number of tubes falls away again.

The hydrothecæ are borne in two opposite series on the axial tubes. They are very regularly alternate in position and are close-set, each hydrotheca overlapping the distal and the proximal portion of its predecessor and successor respectively, on the opposite side of the axial tube. They lie in one plane. The bodies of the hydrothecæ are cylindrical with a somewhat bulging profile, and lie closely adpressed to the axial tube for more than two-thirds of their length; while the terminal portion curves gently away from the stem and projects for a short distance through the fascicle of peripheral tubes. The aperture of a hydrotheca is round and lies in the same plane as the long axis of the hydroclade. Its borders are smooth and are slightly everted, and there is little tendency to regeneration of hydrotheca, for at most two reduplicated margins occur. The base of the hydrotheca passes into a slightly bulging portion of the axial tube, corresponding to a hydrothecal peduncle, and is marked by the presence of a strong diaphragm which slants from the outside inwards and downwards. There is a scarcely appreciable thickening of the exterior wall where the angle due to the outward bending of the hydrotheca occurs.

Many sarcothecæ are scattered on stem and branches. On the external peripheral tubes, they appear to be placed at fairly regular intervals; and their structure is constant. They are short, cylindrical bodies, of diameter wide as compared with their length. Each is perched on a tooth-like forward-projecting

process which arises from the peripheral tube, and which tapers to the tip, where its diameter is considerably less than that of the free portion of the sarcotheca. Often the sarcotheca is represented only by the stiff basal portion, for the distal portion is delicate and is slightly attached. *Gonosome.*—Not present.

Remarks.—I have compared this specimen with fragments of the specimens collected by the "Challenger" and named by Allman *Perisiphonia filicula* and *Perisiphonia pectinata.*[21]. There can be no doubt it is specifically identical with the former, notwithstanding discrepancies between the characters given above and Allman's description and figures. Comparison of a fragment of one of the specimens of *P. filicula* examined by Allman with his description shows that the latter is misleading. Thus, the hydrothecæ are described as "flask-shaped," with the "neck" short and stout, and in the figures they are represented as retort-shaped with a bulging proximal portion tapering upwards into a much narrower so-called "neck." In reality, the diameter of a hydrotheca is almost constant throughout, and the neck can be distinguished only because of its outward curvature. The distinction between a hydrotheca and its "peduncle" is exaggerated in the figures, for in the specimen their continuity of profile is unbroken, and only the internal diaphragm marks their junction. The sarcothecæ are misrepresented in Allman's fig. 2, for all the perfect specimens I have seen consist of a fixed process from a stem tube, surmounted by a short movable cylindrical limb. Again, in Allman's figures, a sarcotheca springs from the axial tube immediately beneath each hydrotheca, but I find no trace of such a sarcotheca. These modifications show that no difference of import exists between Allman's *P. filicula* and the "Thetis" specimen—that their dimensions are also in close correspondence a glance at the following table will show.

Regarding the identity of *P. filicula*, Allman, and *P. pectinata*, Allman, which Pictet and Bedot have urged, there is more room for doubt. The fragment of the type specimen of *P. pectinata*[22] which I have examined differs from *P. filicula* in respect of the greater distance which separates the hydrothecæ; the greater length and slenderness of their free portions; the sharp angle at which they bend away from the stem, and which is indicated on the abcauline wall by an internal thickening of chitin; the greater length of the sarcothecæ, which project sometimes to the height of the hydrothecæ, and which are less distinctly, or not at

[21] Allman—Rep. Sci. Res. "Challenger," Zool., xxiii., 1888, Hydroida, p. 45, pl. xxi., figs. 2, 2*a*, 2*b*.

[22] See Plate lxxxvii., fig. 2.

all, divided into a fixed peduncular, and a free terminal portion. In *P. pectinata*, also, regeneration has occurred in the hydrothecæ and sarcothecæ much more abundantly than in *P. filicula*, for in the former hydrothecæ occur each with as many as thirteen successive margins.

In view of these differences, and in spite of the odd variations described by Pictet and Bedot,[23] I cannot agree to the union of Allman's two species until forms more definitely intermediate are found.

Dimensions in mm. :—

Organs.	"Thetis" specimens.	Allman's type of *Perisiphonia filicula*.	Allman's type of *Perisiphonia pectinata*.
Peripheral tube, diameter...	0·05-0·06	0·045-0·07	0·055
Hydrotheca, length adnate to axial tube	0·33-0·36	0·38	0·36-0·38
Hydrotheca, length free from axial tube	0·13-0·17	0·14	0·31-0·32[24] 0·15-0·19
Hydrotheca, diameter at mouth	0·111-0·123	0·117-0·144	0·084-0·099
Sarcotheca, length[25]...	0·07-0·10	0·055-0·12	0·15-0·28[24] 0·12-0·10
Sarcotheca, diameter	0·027	0·027-0·030	0·024-0·027
Distance between adjacent hydrothecæ on hydroclades[26]	0·46-0·49	0·39-0·44	0·62-0·66

P. filicula I regard as a synonym of Johnson's *Cryptolaria exserta*, of which characteristic figures are given by that author, fig. 3*b* exhibiting unmistakeably the presence of nemataphores. The latter name is prior in time.

Regarding the relationships of similar forms described by other authors, it is impossible to decide. The general appearances of the colonies described as *P. pectinata* by Pictet and

[23] Pictet and Bedot—Res. Camp. Sci. Monaco, fasc. xviii., 1900, Hydraires, p. 20.

[24] The numerator gives the total length of a hydrotheca or sarcotheca including reduplicated margins, the denominator, the length of the *primary* hydrotheca or sarcotheca in the same series.

[25] From the surface of the peripheral tube to the tip.

[26] Measured from any point of one hydrotheca to the corresponding point of that next to it on the same side of the axial tube.

Bedot[27] and *P. chazaliei* by Clarke[28] seem to me to indicate *P. filicula*, while the original *P. chazaliei* as described by Versluys[29] resembles, on the other hand, Allman's *P. pectinata*.

Localities.—Station 57, off Wata Mooli, three and a half to four miles from shore; depth, 59 to 54 fathoms; bottom, mud; 22nd March, 1898.

Family SERTULARIDÆ.

SERTULARELLA ADPRESSA,[30] *sp. nov.*

(Plate lxxxv., fig 5; Plate lxxxviii., figs. 1, 2, and 9.)

Stations 36 and 54.

From each of two Stations comes a single example of this species. That from Station 54 is the larger and more mature colony and its growth is more complex.

Trophosome.—The habit of the colony is striking. The stems, stout (up to 3 mm. in diameter), and strongly fascicled, spring from a clump of hydrorhizal tubes, and bear irregularly arranged, long, fascicled branches, the first of which may arise quite near the base of the colony. The branches reach a length of 6 cms., and bear branches, which again carry branches, and these again, to the fourth degree. Stem and branches are furnished with regularly arranged, alternate pinnæ, up to 18 mm. in length, although the general size is about 10 mm. Two pinnæ on the same side are separated by slightly under 3 mm. Branches and pinnæ lie in one plane, and so frequent is anastomosis between branch and stem, and pinna and branch, that a colony may be bound into a flabelliform mass, and even two or more colonies may become inseparably united. Formed in this way, the largest specimen before me forms an expanse 10 cm. high by 9 cm. broad.

Where it is free from fascicle tubes, the stem can be seen to be divided into regular internodes separated by oblique nodes which slope successively in opposite directions. Each internode bears three hydrothecæ, following each other in a close succession, which is seldom interrupted by nodes. Indeed, in the majority of the pinnæ, there is no trace of division into internodes.

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[27] Pictet and Bedot—Res. Camp. Sci. Monaco, fasc. xviii., 1900, p. 18, pl. iv., figs. 1-4, pl. v.

[28] Clarke—Mem. Mus. Comp. Zool. Harvard, xxxv., 1, 1907, p. 15, pls. 11-13.

[29] Versluys—Mem. Soc. Zool. France, xii., 1899, p. 32, figs. 2-4.

[30] *ad*, and *premo*, to press, signifying the adpressed condition of the gonangium.

The hydrothecæ are tubular, gradually bending outwards. Their adcauline wall is altogether adnate to the pinna, except for a distal moiety, comprising little more than the adcauline tooth. Exceptionally, a slightly larger portion is free, and this generally on the stem. Also where several regenerated margins have succeeded each other within the old margin, as often happens, it appears as if a larger portion were free; but, as a rule, there is little variation, virtually the entire adcauline wall of any primary hydrotheca being adnate. The margin of the hydrotheca is divided into three equal and equidistant teeth, one adcauline, central and projecting, the others forming an abcauline lateral pair, which scarcely project beyond the line of the abcauline wall. The teeth are separated by deep embayments. The operculum has three flaps. The hydrothecal walls are strongly developed; the abcauline terminates at the aperture in a knob of chitin, and the cavity of the hydrotheca is cut off from that of the stem by a horizontal base, from the inner corner of which very short chitinous supports project downwards.

The soft parts are poorly preserved, but these points were distinguished:—A single tube of cœnosarc runs throughout the colony, and from it the hydranths are given off on short branches. The hydranths, which enter through the anterior half of the base of a hydrotheca, have about fifteen tentacles, and possess a small blind-sac, from which proceeds a protractor muscle attached to the distal half of the abcauline wall.

Gonosome.—The gonangia are borne on stem, branches, or pinnæ, but are most common on the last. They arise from the anterior of these, immediately beneath a hydrotheca, and lie so closely against the pinna that the adcauline portion of the gonangium becomes hollowed to fit it, as in the case of *Thecocladium flabellum*, Allman, while the margins of the gonangium show more intimate adaptation to the outlines of hydrothecæ and internode. The profile is very different as seen in frontal and lateral aspects (*cf.*, Plate lxxxviii., figs. 1 and 2). No distinct stalk is present, and in the former view they appear as much elongated (length three times maximum breadth), slightly club-shaped bodies, with a small circular aperture which lies a little within the upper margin and faces the observer. In lateral aspect, the profile is wedge-shaped, for the gonangium widens gradually towards the summit, the adcauline distal edge being produced in a short angle along the stem, while the abcauline edge is replaced by the aperture, termino-lateral in position, facing upwards and outwards, placed upon a short narrow tube with trumpet-shaped lip, the tube set in a shallow depression of the gonangium wall. Faint traces of annulation sometimes occur, especially on the distal half of the gonangium. In the cases where the preserva-

tion of the cœnosarc permitted discrimination to be made, the gonangia were found to contain large ova, about five in number.

Dimensions.—

Stem internode, greatest length	1·22-1·36 mm.
Pinna, diameter	0·42 mm.
Hydrotheca, length	0·39 mm.
Hydrotheca, diameter	0·16-0·18 mm.
Gonangium, length	2 mm.
Gonangium, greatest breadth (frontal aspect)	0·64-0·73 mm.
Gonangium, greatest breadth (lateral aspect)	0·52-0·63 mm.

Affinities.—This species, which belongs to the Johnstoni-group of Hartlaub, seems to be most closely allied to *Sertularella pluma*, Hartlaub, but from that it may be distinguished by the greater length of its pinnæ (at least twice as long); by the presence of a pinna on each internode, by the wider angle at which the pinnæ are set, and especially by the shape and habit of the gonangium.

There is much superficial resemblance also to *Sertularella subarticulata* (Coughtrey), an undoubted *Sertularella*, hitherto referred to *Thuiaria* by authors. In this case, however, Coughtrey, Allman (who described the species under the name *Thuiaria bidens*), and Bale, each describe the hydrothecæ as having two adcauline teeth, although the last adds that "it is often difficult to distinguish more than one tooth on the inner side."[31]

In *Sertularella adpressa*, the single adcauline tooth is unmistakable and invariable. There are great differences between these species, also, in the structure and habit of the gonangium.

Localities.—Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898; young colony without gonangia. Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898; large colony with gonangia.

Type Specimens.—In the Australian Museum, Sydney.

SERTULARELLA DIVARICATA (*Busk*),

var. SUBDICHOTOMA, *Bale.*

Sertularella subdichotoma, Kirchenpauer (*in parte*), Abh. Nat. Ver. Hamburg, viii., p. 46 (*fide* Hartlaub, 1900, p. 33).

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[31] Bale—Proc. Linn. Soc. N.S. Wales, (2), iii., 1888, p. 746.

Sertularella divaricata, var. *subdichotoma*, Bale, Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 761, pl. xvi., figs. 3, 4. *Id.*, Hartlaub, Abh. Nat. Ver. Hamburg, xvi., 1900, p. 23.

Station 44.

A minute fragment, only about 3 cms. long, shows the characteristic lax and irregular branching, and the other structural details of Bale's variety. Scarcity of material, and the absence of gonangia, alike forbid speculation as to the possibility of identity between this Australian variety and the South American and Antarctic *Sertularella subdichotoma*, Kirchenpauer, excellently and minutely described and figured by Hartlaub (1900).

Dimensions.—

Internode, length.....	0·43-0·63 mm.
Hydrotheca, length adnate	0·14-0·20 „
„ „ free	0·11-0·15 „
„ diameter at mouth...	0·14-0·16 „

Locality.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898.

This variety has previously been recorded only from Port Jackson (Bale), and Bass Strait (Kirchenpauer).

SERTULARELLA LONGITHECA, *Bale, typica.*

(Plate lxxxviii., fig. 7.)

Sertularella longitheca, Bale, Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 762, pl. xvi., figs. 5, 6. Bale, Trans. Roy. Soc. Vict. (n.s.), vi., 1894, p. 101, p iv., figs. 7-9. Hartlaub, Abh. Nat. Ver. Hamburg, xvi., 1900, p. 21.

Station 57.

A few diminutive but typical examples of this species were found at only one Station. They form delicate, straggling, unbranched stems up to 30 mm. in length. Bale's figures are characteristic, the most marked features of the trophosome of the species being the length of the hydrothecæ, associated with their small calibre, regularly tubular shape, and the large proportion which is free from the stem. The specimens before me rarely show definite nodes between hydrothecæ, and in distinction from the variety following, the stem is straight, showing no signs of geniculation.

The significant measurements of the trophosome agree fairly closely with calculations made from Bale's figures, except that in the present specimens a larger proportion of the hydrotheca is free from the stem. *Gonosome* not present.

Dimensions.—

Organs.	Present specimens.	Bale's Figures.
Stem, diameter	0·73-1·47 mm.	0·47-0·60 mm.
Distance between hydrothecæ	0·18-0·21 ,,	0 25 mm.
Hydrotheca, length adnate	0·29-0·41 ,,	0·37-0·40 mm.
,, ,, free	0·36-0·42 ,,	0·25-0·32 ,,
,, diameter at mouth	0·17 mm.	0·17-0·20 ,,

Locality.—Station 57, off Wata Mooli, three and a half to four miles off shore; depth, 59 to 54 fathoms; bottom, mud; 22nd March, 1898.

Sertularella longitheca has hitherto been found only at Port Denison (Bale, 1888), and Port Phillip (Bale, 1894).

SERTULARELLA LONGITHECA, *Bale*,

var. ROBUSTA, *var. nov.*

(Plate lxxxviii., fig. 8.)

Stations 36, 44, and 48.

Specimens from two Stations appear to belong to a variety of the above species. They occur in short monosiphonic colonies, only about 3 cm. in height, lax in growth, with rare and irregular branches which spring, with a long internode, from directly beneath a hydrotheca, and which are similar to the longer "stem." In the older portions of the colonies, owing to the great thickness of the perisarc, the nodes become obscured, although a slight constriction immediately distal to a hydrotheca generally indicates their position. The internodes do not lie in a straight line, as in Bale's figure (1888, pl. xvi., fig. 5), but are zig-zag, bending to one side and the other in gentle curves which follow the inner lines of the hydrothecæ.

The hydrothecæ lie towards the distal ends of the internodes, and are remarkable for their great depth and for the length of the adnate portion. They are not quite tubular, as in the typical form, but reach a maximum diameter at the point where they become free, tapering slightly downwards until they end in a rounded base, and less markedly towards the mouth. Many show indications of a faint rugosity on the free adcauline wall. There is some variation in the proportion of the adnate part of the hydrotheca. In no case has so small a portion as a third been observed, although such occurs in the typical form; for the

proportion is generally over a half, and almost as much as two-thirds may be adnate. In these specimens, also, the three hydrothecal teeth are less prominent than in Bale's figure of the typical examples.

None of the characteristic gonangia were present, but in spite of this, and of the divergences from typical specimens, which I have noted above, I do not hesitate to regard these as belonging to a form of *Sertularella longitheca*.

The following measurements show that the hydrothecæ are much larger than those of the typical form; the whole growth is coarser, and to this is due the varietal name *robusta*.

Dimensions.—

Internode, length	0·75-0·94 mm.
,, diameter	0·22-0·29 ,,
Hydrotheca, length adnate	0·57-0·66 ,,
,, ,, free	0·38-0·43 ,,
,, diameter at mouth	0·28-0·32 ,,

Localities.—Station 36, off Botany Bay, one mile from shore; 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898; a few small colonies. A single small fragment was observed intertwined with Polyzoa colonies from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898. Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; several colonies growing on submerged débris.

Type Specimens of variety.—In the Australian Museum, Sydney.

SERTULARELLA TURGIDA (*Trask*)?.

(Plate lxxxviii., fig. 6.)

Sertularia turgida, Trask, Proc. Calif. Acad. Sci., i., 1854-57, p. 113, pl. iv., fig. 1.

Sertularella turgida, Clarke, Trans. Conn. Acad., iii., 1876, p. 259, pl. xxxviii., figs. 4, 5. *Id.*, Hartlaub, Abh. Nat. Ver. Hamburg, xvi., 1900, p. 67, pl. 2, fig. 30, pl. 3, figs. 21, 22, text-figs. *Id.*, Torrey, Univ. California Publ., Zool., i., 1902, p. 64, pl. 7, figs. 59-62, pl. 8, figs. 63-69. *Id.*, Nutting, American Hydroids, Part ii. The Sertularidæ, Spec. Bull U.S. Nat. Mus., 1904, p. 95, pl. 22, figs. 2-5. *Id.*, Torrey, Univ. California Publ., Zool., ii., 1904, p. 29, figs. 22, 23.

Sertularella conica, Calkins, Proc. Boston Soc. Nat. Hist., xxviii., 1899, p. 359, pl. 4, fig. 22.

Sertularella nodulosa, Calkins, *Loc. cit.*, p. 360, pl. 5, fig 29.

Station 57.

With hesitation I refer two minute colonies to this species. The larger consists of a hydrorhizal tube from which a stem, 11 mm. high, springs. The stem is slightly geniculated and is divided into long slender internodes, at the distal end of each of which a hydrotheca is borne. The hydrothecæ resemble those of *Sertularella polyzonias* in general shape, but they have only three marginal teeth. The salient characters may be summarised thus:—Hydrothecæ adnate for less than one half of their length to the stem, the free portion being strongly exserted, projecting from the stem abruptly almost at a right angle, and narrowing to the orifice. The abcauline wall is straight, and occasionally slightly waved, but the adcauline is marked by several definite undulations. The apertures are obscured by the presence of very many reduplicated margins, but they show that the hydrothecæ are furnished with three teeth and that intrathecal teeth are absent.

In all these respects our specimen agrees with Hartlaub's description, and it also bears close resemblance to the figure given by him (1901, pl. iii., fig. 21) of a specimen from Bare Island, Vancouver; and to that given by Nutting (1904, pl. xxii., fig. 3).

The greater length of the internodes and the straighter profile of the hydrothecæ in our specimens bring them into line with a Japanese specimen described by Nutting (1901, p. 95).

It seems legitimate, therefore, to consider that our specimens fall within the bounds of a species which is "by far the most variable on the [Californian] coast" (Torrey, 1904, p. 29), although, owing to the absence of the gonotheca, which is characteristic, absolute identification is inadvisable.

Dimensions.—

Stem, diameter	0·18-0·21 mm.
Length between hydrothecæ	1·20-1·41 „
Hydrotheca, length free	0·36-0·49 „
„ „ adnate	0·32-0·38 „
„ diameter at mouth	0·18-0·22 „

Locality.—Station 57, off Wata Mooli, three and a half to four miles from shore, 59 to 56 fathoms; bottom, mud; 22nd March, 1898.

The species is new to Australian seas. It has hitherto been recorded only from the Pacific Coast of North America—from

the neighbourhood of San Diego to the neighbourhood of Queen Charlotte Islands on the coast of British Columbia; and a single specimen was found at "Albatross" Station 3775, "off Japan."

THUIARIA SINUOSA, *Bale.*

(Plate lxxxv., fig. 4.)

Thuiaria sinuosa, Bale, Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 772, pl. xviii., figs. 9, 10.

Station 54.

This species does not seem to have been referred to since Bale published his original description from "a small piece taken from a specimen in the Museum, which is about two inches high, and incomplete." The present specimens give a better idea of the mature growth of the species, for the largest is 125 mm. long, with a straight stem, fascicled to within 25 mm. of the tip, 2 mm. in diameter at the base, and gradually tapering upwards. Although the majority of the colonies are simple, the largest bears, 4 mm. from the base, a strong branch in all respects similar to the stem, while another fragment bears three branches, from one of which spring similar branches of second degree.

Occasionally, some of the lower pinnæ show a special development, for the hydrothecæ disappear, and the central tube is continued as a stolon-like process. The utility of such a development is manifest where the modified pinnæ actually come to function as stolons which, attached to a substratum, give rise to new and practically independent colonies (Pl. lxxxv., fig. 4). This phenomenon in *Thuiaria sinuosa* corresponds to the production of "rameaux stoloniques," a vegetative process adopted as a subsidiary mode of reproduction by many Hydroid species.[32]

Gonangia are present on several of the colonies.

Dimensions.—

Stem, diameter of cladate tube (including hydrothecæ)	0·56	mm.
Pinna, length	up to 25	,,
,, diameter (including hydrothecæ)	0·46-0·56	,,
Hydrotheca, length	0·47-0·56	,,
,, greatest diameter	0·12-0·15	,,
Gonangium, length	1·5	,,
,, greatest diameter	0·67-0·74	,,

Locality.—Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898. Hitherto recorded only from Port Molle, Queensland.

[32] See Billard—Ann. Sci. Nat., Zool., (8), xx., p. 12, *et seq.*

SERTULARIA ELONGATA, *Lamouroux.*

Sertularia elongata, Lamouroux, Hist. Polyp. Corral. fléxibles, 1816, p. 189, pl. v., figs. 3*a*, B, C. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 75, pl. vi., figs. 7, 8., pl. xix., fig. 7. *Id.*, Billard, Ann. Sci. Nat., (9), vi., 1907, p. 217, fig. 2.

Sertularia millefolium, Lamarck, Hist. nat. Anim. sans Vertèbres, 1816, p. 116.

Sertularia lycopodium, Lamarck, *Ibid.*, p. 117.

Sertularia scandens, Lamouroux, *Op. cit.*, p. 189.

Dynamene abietinoides, Gray in Dieffenbach, Travels in New Zealand, 1843, ii., p. 294.

Sertularia abietinoides, Coughtrey, Trans. N. Zeal. Inst., vii., 1875, p. 285, pl. xx., figs. 16, 18-20.

Station 40.

Recorders agree in ascribing a wide range of variability to this characteristically Australian species. The present specimens, colonies 4 to 5 cms. long, with pinnæ averaging about 5 mm., are notable for the robustness of their minute structures—the strength of the hydrothecal teeth, and the great thickness of the hydrothecal walls in the free adcauline portion, being especially noticeable. Yet the hydrothecæ are much smaller in size than the average.

Dimensions.—

Stem, length of internode	0·68-0·73 mm.
Hydrotheca, length of external profile	0·25-0·29 „
„ „ „ adnate portion	0·21-0·32 „
„ diameter	0·11-0·14 „
„ thickness of abcauline wall	15-21μ.
„ „ „ free adcauline wall	15-21μ.
Gongium, length	up to 2 mm.
„ maximum diameter	0·77-0·99 mm.

Locality.—A small clump of colonies from Station 40, off Wata Mooli, three miles from shore; depth, 52 fathoms; bottom, sand and boulders; 12th March, 1898.

SERTULARIA MINIMA, *Thompson.*

Synthecium gracilis, Coughtrey, Trans. N.Z. Inst., vii., 1875, p. 186, pl. xx., figs. 26-31 (name preoccupied).

Sertularia pumila, Coughtrey, Trans. N.Z. Inst., viii., 1876, p. 301, and Ann. Mag. Nat. Hist., (4), xvii., 1876, p. 29.

Sertularia minima, Thompson, Ann. Mag. Nat. Hist., (5), iii., 1879, p. 104, pl. xvii., figs. 3, 3*a*, 3*b*. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 89, pl. iv., figs. 9, 10, pl. xix., figs. 12, 13. *Id.*, Allman, Journ. Linn. Soc., Zool., xix., 1886, p. 138, pl. xiii., figs. 3, 4. *Id.*, Etheridge, Austr. Mus. Mem., No. 2, 1889, p. 41. *Id.*, Marktanner-Turneretscher, Ann. k.k. Hof.-Mus. Wien., v., 1890, p. 231. *Id.*, Thornely, Journ. Linn. Soc., Zool., xxxi., 1908, p. 83.

Sertularia pumiloides, Bale, Journ. Micro. Soc. Vict., ii., 1882, p. 21, pl. xii., fig. 2.

Stations 34, 36.

Trophosome.—The present specimens of this species differ from typical forms in the greater elongation of their internodes, and in the obscurity of the stem nodes, particularly on the lower portion of a stem. They thus come to resemble *Sertularia distans*, a species to which they are apparently very closely related; but the distinguishing points are to be found in the robustness of build of *Sertularia minima*, the marginal teeth being especially long and strong; in the comparatively large proportion of the hydrotheca which is adnate to the stem, the small proportion which is free; and in the small proportion of a hydrotheca-pair which is contingent in front of the stem.

Coughtrey, Bale, and Allman refer to transverse markings in the hydrohiza. They are here well developed in the colonies from both Stations, consisting of ribs of chitin which run vertically up the sides of the tubes at irregular intervals, and project across the cavity of the tube for about a quarter of its breadth. Viewed from above, they appear as piers of chitin running out from the lateral walls and terminating in a hammer-headed knob. Such a type of supporting structure is by no means of definite specific value, however, for in my own experience they occur in the hydrorhizal tubes of species so widely separated as *Podocoryne anechinata*,[33] *Sertularia heterodonta*,[34] and *Plumularia lagenifera*, var. *septifera*;[35] while Warren has described them as characteristic of *Pasythea quadridentata*,[36] and Bale (1884, p. 90) says they occur in many species of *Plumularia*. It is apparent that such strengthening ribs are analogous developments in very diverse forms, perhaps induced, as I have suggested, where the

[33] Ritchie—Proc. Zool. Soc., 1907, p. 499, pl. 23, fig. 10.

[34] Ritchie—Trans. Roy. Soc. Edinb., xlvii., 1909, p. 79.

[35] Ritchie—*Ibid.*, p. 88, fig. 7*b*.

[36] Warren—Ann. Natal Gov. Mus., i., 1908, p. 313, fig. 11.

hydrorhizal tubes are subjected to unusual buffeting and rough usage owing to wave action or other causes.

Gonosome.—Gonangia are present on several of the colonies.

Dimensions.—

Total height	up to 9 mm.
Stem internode, length	0·45-0·53 mm.
,, ,, diameter at base of hydrotheca	0·15 mm.
Hydrotheca,[37] length of external profile	0·31 ,,
,, length of free portion	0·17-0·20 mm.
,, ,, of adnate portion	0·25-0·28 ,,
,, diameter at mouth	0·07-0·09 ,,
Gonangium, length	1·09-1·15 ,,
,, maximum diameter	0·75-0·82 ,,

Localities.—Station 34, off Port Jackson, three and a half to two and a half miles from shore; depth, 39 to 36 fathoms; bottom, sand and mud; 10th March, 1898; not common, growing on a Polyzoon. Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898; in clusters on foreign objects.

SYNTHECIUM CYLINDRICUM (*Bale*).

Sertularella cylindrica, Bale, Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 765, pl. xvi., fig. 7.

Var.—*Sertularella cylindrica*, var. *pusilla*, Ritchie, Proc. Zool. Soc., 1910, p. 817, pl. lxvii., fig. 9.

Sertularella halecina, Torrey, Univ. California Publ., Zool., i., 1902, p. 61, pl. v., fig. 55, pl. vi., fig. 56.

Synthecium cylindricum, Nutting, American Hydroids, Pt. ii., 1904, p. 136, pl. xli., fig. 7.

Stations 44 and 48.

The occurrence of many colonies in this collection allows of the addition of several details, especially as regards variation, to the description of Bale, and to my recent notes on diminutive Indian Ocean specimens. Most striking, on first examination, is the evil condition of the colonies, for the hydrothecæ, having extremely thin walls, have almost all collapsed, and many have been wrenched from their places.

Trophosome.—A creeping hydrorhizal tube ramifies over a branched Isid Alcyonarian, and anastomoses with neighbouring tubes, thus forming an entangled mesh-work. From this, at

[37] Measurements taken to tip of teeth.

irregular intervals, the unfascicled stems of the colonies arise reaching occasionally a height of 53 mm., and averaging between 30 and 40 mm. The stem is almost straight and generally bears short, irregularly-set (never opposite) branches, which leave it at a wide angle, lie in one plane, and themselves bear branchlets to the second degree. It is built of very thick perisarc, and although not divided into internodes with the regularity which Bale suggests, it bears hydrothecæ, and is marked by occasional deep constrictions. The branches, although, as a rule, they are short and simple, occasionally reach a length of 20 mm., and bear offshoots of second degree. They arise from the stems at a point proximal to a hydrotheca, and a little to one side. The branches are not in general divided into regular internodes, but the interthecal portions widen considerably from below upwards so that each hydrotheca appears to rest on a bracket.

From one to four hydrothecæ occur between successive nodes, but they are not separated by equal distances, for, almost a millimetre apart at one place, at another they are so close that the base of one is opposite the adnate portion of its predecessor. The hydrothecæ are "large, stout, cylindrical, smooth, usually somewhat rounded at the base, curved outwards," and in all respects agree with Bale's figure and description, except as regards the proportion attached to the internode. In Bale's specimens, they are "adnate nearly half their height," while in the present specimens only one-third of the total height is attached. This is due chiefly to the greater length of the free portion, the actual length attached being almost equal in both cases. I refer again to the great tenuity and delicacy of the walls of the hydrothecæ and to their consequent poor state of preservation.

Gonosome.—Not present.

Dimensions.—

Hydrorhiza, diameter	0·38 mm.
Stem, diameter	up to 0·39 mm.
Hydrotheca, total length[38]	0·80-0·84 mm.
,, length adnate	0·27-0·32 mm.
,, diameter at mouth	0·32 mm.
Distance between corresponding points of successive hydrothecæ	0·26-0·98 mm.

The above measurements agree closely with those deduced from Bale's figure, but they are very much larger than those of the examples I have recorded from the Mergui Archipelago as *Sertu-*

[38] Primary hydrothecæ were measured; the rim of a secondary hydrotheca may increase the length by about 0·1 mm.

larella cylindrica, var. *pusilla*. They show, moreover, that the proportions of *Synthecium alternans*, Allman, (in which more than half of the hydrotheca is adnate) differ very markedly from those of *S. cylindricum*.[39] Add to this the dissimilarity between the habits of these two species. *S. alternans* is, according to Allman,[40] "a strong, rather rigid form, with the stem fascicled towards the base, ... set with pinnately-disposed, equidistant, alternate ramuli," which, in his figure are unbranched; while *S. cylindricum* is a somewhat lax form with unfascicled stem, with branches which are irregularly set, not equidistant, and not necessarily alternate, and which are themselves sometimes branched. Consideration of these differences convinces me that Billard (*loc. cit.*) has erred in regarding *S. cylindricum* as a synonym of *S. alternans*.

Localities.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898; many colonies. Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; few small colonies.

In addition to the Port Jackson records of Bale, and those other Australian records given above, this species has been found in San Diego Bay, California, whence it has been described by Torrey as *Sertularella halecina*.

SYNTHECIUM ORTHOGONIUM (*Busk*).

Sertularia orthogonia, Busk, Voy. "Rattlesnake," i., 1852, p. 390. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 88, pl. ix., fig. 11.

Synthecium orthogonia, Bale, Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 767, pl. xvii., figs. 1-5.

Synthecium orthogonium, Kirkpatrick, Sci. Proc. Roy. Dublin Soc. (n.s.), vi., 1890, p. 604. *Id.*, Billard, Ann. Sci. Nat., Zool. (n.s.), xi., 1910, p. 25.

Stations 10, 36, 54, and 57.

Examples of this species come from four Stations, those from Stations 36 and 54 being the more typical in appearance, and resembling Bale's figure (1888, pl. xvii., fig. 1), while those from

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[39] *Cf.* the above measurements with those of *S. alternans* type, given by Billard—Ann. Sci. Nat., Zool., (n.s.), xi., 1910, p. 27.

[40] Allman—Rep. Sci. Res. "Challenger," Zool., xxiii., 1888, Hydroida, Pt. ii., p. 80.

Station 10 more closely resemble *Synthecium patulum*, for the adnate portion of the hydrotheca is longer, the aperture faces upwards as well as outwards, is highly sinuous at the sides, and is seldom reduplicated. I cannot consider those specimens as belonging to distinct species, however, for the apertures of the primary hydrotheca (*i.e.*, the hydrotheca first formed, before reduplication of the margin has commenced) face upwards and their margins are slightly sinuous even in the more typical forms. Nor do the measurements of the two forms collected by the "Thetis" justify separation, for in each there is a wide range of variability. I do not feel assured, however, that the *patulum*-like form in this collection is identical with *Synthecium patulum* (Busk); hence I refrain from adding that name to the list of synonyms. No gonangia are present.

Dimensions.—

Organs.	Specimens from Station 10.	Specimens from Station 54.
Distance between branches	2·5 4 mm.	3-4 mm.
Branch internode, length	0·80-0·96 mm.	0·72-0·74 mm.
Hydrotheca, length adnate	0·57-0·67 ,,	0·43-0·60 ,,
,, ,, free	[41]0·14-0·18 ,,	0·14-0·18 ,,
	0·22-0·29 ,,	
,, diameter of lower portion	0·16-0·18 ,,	0·15-0·18 ,,
,, diameter of mouth	0·13-0·19 ,,	0·14-0·22 ,,

These measurements do not agree very closely with Billard's measurements of Busk's type specimens.

Localities.—Station 10, two to four and a half miles off Broken Head; depth, 28 fathoms; bottom, fine sand; 22nd February, 1898; many poor colonies. Station 36, one mile off Botany Bay; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898; few fragments. Station 54, Jervis Bay (within); depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898; several colonies. Station 57, three and a half to four miles off Wati Mooli; depth, 59 to 54 fathoms; bottom, all mud; 22nd March, 1898; fragments.

DIPHASIA SUB-CARINATA (*Busk*).

Sertularia sub-carinata, Busk, Voy. "Rattlesnake," i., 1852, p. 390.

[41] Primary hydrotheca, *i.e.*, excluding the reduplications.

Diphasia sub-carinata, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 102, pl. iv., fig. 1, pl. xix., fig. 18. *Id.*, Kirkpatrick, Sci. Proc. Roy. Dublin Soc. (n.s.), vi., 1890, p. 604.

Station 54.

The following observations supplement the accounts of Busk and Bale. The hydrothecate lower portion of the stem is separated from the node-bearing portion by an articulation very oblique in lateral view, and resembling from the front two cones, the points of which interpenetrate. This type of node prevails throughout the colonies, but in the older portion of the stems age has obliterated the definiteness of the structure. In the hydrotheca, there is a very marked thickening of the abcauline wall where it bends outwards, but the inner margin of the thickening is smoothly rounded and is not produced into a fine ridge as in several species. The lateral ridge, on account of which the species has obtained its name, is due to a compression of the free portion of the hydrotheca from above downwards, and while apparent both on the anterior and posterior of the free part of the hydrotheca, it cannot, in these specimens, be detected in the adnate portion. The general resemblance in structure between this species and *Diphasia tetraglochina*, Billard, is very marked, but a comparison of dimensions further emphasises the distinctness which Billard[42] records. No trace of gonosome is present.

Dimensions.—

Height of colony	up to 17 mm.
Internode, length.....	0·74-0·80 mm.
Hydrotheca, length adnate.....	0·49-0·52 ,,
,, ,, free[43]	0·33-0·36 ,,
,, diameter of lower portion	0·12-0·15 ,,
,, ,, at mouth	0·15-0·25 ,,

Locality.—A small clump growing on *Thuiaria sinuosa* from Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898.

The species has been recorded only from Australian waters, from Torres Strait to Bass Strait, at depths varying from 5½ to 45 fathoms.

Family PLUMULARIDÆ.

PLUMULARIA SETACEA (*Linnaeus*).

Sertularia setacea, Linnaeus, Syst. Nat., Ed. 10, 1758, p. 813.

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[42] Billard—Arch. Zool. exper. (4), 1907, vii., pp. 358, 359.

[43] To tip of lateral tooth.

Plumularia setacea, Lamarck, Hist. nat. Animaux sans Vertèbres, ii., 1816, p. 129. *Id.*, Hincks, Hist. Brit. Hydroid Zoophytes, 1868, p. 296, pl. lxvi., fig. 1. *Id.*, Bale, Proc. Linn. Soc. N. S. Wales (2), iii., p. 778, pl. xx., figs. 14-18. *Id.*, Billard, Exp. Sci. "Travailleur" et "Talisman," viii., 1907, p. 209.

Plumularia tripartita, von Lendenfeld, Proc. Linn. Soc. N. S. Wales, ix., 1885, p. 477, pl. xii., figs. 8-10.

A single broken stem of this widely-distributed species was found entangled amongst Polyzoa. The example is notable for its grace and delicacy, this being due to the extraordinary length and relative slenderness especially of the stem-internodes, but also of the hydrotheca-bearing hydroclade internodes. The dimensions given below show that in these respects the Australian specimens even exceed that of the elongate variety obtained by the "Travailleur" near the Strait of Gibraltar.[44] No gonangia were present.

Dimensions.—

Stem internode, length	0·52-1·03	mm.
,, ,, diameter	0·08-0·13	,,
Hydroclade internode, hydrothecate, length	0·47-0·52	,,
,, ,, intermediate, ,,	0·31-0·32	,,
,, ,, ,, diameter	0·05	,,
Hydrotheca, depth	0·08-0·10	,,
,, diameter at mouth	0·10-0·12	,,

Locality.—Within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898.

Plumularia setacea has already been recorded from Australia —Port Phillip, Victoria (von Lendenfeld), Port Phillip Heads (Bale).

PLUMULARIA SULCATA, *Lamarck.*

(Plate lxxxiv., fig. 3; Plate lxxxix., fig. 5.)

Plumularia sulcata, Lamarck, Histoire nat. Animaux sans Vertèbres, ii., 1816, p. 128. *Id.*, Billard, Ann. Sci. Nat. Zool. (9), v., 1907, p. 321.

Plumularia aglaophenoides, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 126, pl. x., fig. 6.

Station 48.

A solitary but magnificent colony represents the rare species excellently described by Bale in 1884, from a fragment two

[44] Billard—1907, p. 210.

inches long, and named by him *Plumularia aglaophenoides*. The recent examination of the original specimen in Lamarck's type collection by Dr. Armand Billard leaves no doubt that this species is identical with *Plumularia sulcata*, Lamarck, and the "Thetis" specimen agrees even more closely with Billard's description of Lamarck's type than does that of Bale. The fragmentary nature of Bale's specimen and the no less imperfect condition of the type, which is recorded as 15 or 16 centimetres long, offer excuse for a more complete description of the macroscopic aspect of the colony.

Trophosome.—The stem is polysiphonic and stout, 3·5 mm. in diameter at the base, and is straight and rigid. Although obviously incomplete, it attains a height of 28 cm. and bears four irregularly-placed branches, 2 mm. in basal diameter, the lowest of which springs from the stem 16 cm. from the base, and all of which lie in the same plane. Stem and branches are sinuous—though never sufficiently so to dispel the impression of straightness which the sturdy portions convey—and from the summit of each wave springs a primary hydroclade bearing both hydrothecæ and secondary hydroclades. The primary hydroclades thus lie in one plane, alternating in a pinnate series. Two primary hydroclades on the same side of stem or branch are distant from each other about 6·5 mm., and their length varies from 15 to 20 mm. The lax, scraggy appearance of the colony is well described by Lamarck :—"Cette espèce est maigre, lâche dans toutes ses parties. Sa tige et ses branches offrent des sillons ascendans et ondés."[45]

The stem-fascicle is formed of stout tubes, each of which is armed with a series of opposite sarcothecæ, similar in structure to that which lies proximal to a hydrotheca. On the tubes which issue from the fascicle as primary hydroclades, this paired series commences proximal to the lower of the two markedly oblique joints with which the pinna originates ; and here the tube is divided into a small number of internodes of irregular length. Not only does the internode included between these oblique joints bear sarcothecæ, as both Bale and Billard remark, but in the present specimen it bears a rather undersized hydrotheca, and is exactly like the succeeding thecate internodes, even giving rise, in many cases at least, to a secondary hydroclade. Occasionally hydrothecate internodes, bearing paired sarcothecæ, interrupt the hydrothecate course of the primary hydroclades.

The median sarcothecæ which lie behind a hydrotheca in the axil between it and the hydroclade are rudimentary structures,

[45] Deshayes and Milne Edwards ed. of Lamarck, ii. edition, 1836, ii., p. 164.

exceedingly delicate and hyaline, disc-like in shape, with the inner edge somewhat strengthened (Pl. lxxxix., fig. 5). Their bases are connected by means of a chitinous ridge with the upper edges of the lateral sarcothecæ. The numbers and position of the sarcothecæ vary slightly. Thus the superior pair of bithalamic sarcothecæ on a hydroclade internode may be replaced by a single median individual—a variation which I have seen present in three out of four hydrothecæ on one hydroclade. A similar variation occurs in the sarcothecæ on the proximal internode of the secondary hydroclades, and explains the divergence which Billard points to, between his own observation of two opposite sarcothecæ, and that of Bale, who mentions only one.

Dimensions.—

Hydrotheca, length	0·26-0·28 mm.
,, diameter at mouth	0·23-0·25 ,,
Internode of primary hydroclades, length[46]	0·52-0·66 ,,
,, of primary hydroclades, diameter	0·25-0·31 ,,
,, of secondary hydroclades, length	0·46-0·49 ,,
,, of secondary hydroclades, diameter	0·12-0·14 ,,

Remarks.—In spite of differences between this specimen and the descriptions by Billard and Bale, identity with *Plumularia sulcata* has been confirmed, on further examination of Lamarck's type, kindly undertaken by the former at my request. This examination, Dr. Billard informs me, reveals, as described above, the hitherto unrecorded presence of a hydrotheca on the oblique internode at the base of each pinna, and of a double series of sarcothecæ on the fascicle tubes, both of which characters had been obscured by the delapidation of the original specimen.

Locality.—Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; a single fine colony.

Distribution.—Mers australes (Lamarck); Broughton Islands, 25 fathoms (Bale).

DIPLOCHEILUS MIRABILIS, *Allman.*

Diplocheilus mirabilis, Allman, Rep. "Challenger" Exped., vii., Hydroida, Part i., 1888, p. 49, pl. viii., figs. 4-7. *Id.*, Stechow, Abh. K. Bayer. Akad. Wissensch., 1 Suppl. Bd., 1909, p. 89.

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[46] Owing to the impossibility of defining internodes in the primary hydroclades, this measurement is made from any point of a hydrotheca to the corresponding point of the next hydrotheca.

Kirchenpaueria mirabilis, Bale, Proc. Roy. Soc. Vict. (n.s.), vi., 1894, p. 109, pl. vi., figs. 4-7. *Id.*, Warren, Ann. Natal Govt. Mus., i., 1908, p. 321, fig. 15, p. 323.

Plumularia mirabilis, Billard, Ann. Sci. Nat. (n.s.), xi., 1910, p. 37.

Station 44.

Only a minute fragment of a colony represents this species. The structural details appear to fall between those of typical *Diplocheilus mirabilis* and *Diplocheilus productus* (Bale). With the latter it agrees, especially in the narrowness of the intrathecal ridge at the point where it joins the anterior wall, but this is a variable character; while the widely expanded margin of the hydrotheca shows resemblance to the former. There are generally two hydroclades on each internode, each accompanied by two close-set sarcothecæ, one in the axial above the stem-process on which the hydroclade is borne, the other at the superior interior border of the process. The only other cauline sarcotheca, the position of which approaches constancy, is that which lies close to the distal edge of an internode, in the middle of the anterior surface. The nematocysts within the stem are of large size, 15μ long, by 9μ or 10μ in diameter, but the cœnosarc, apart from these, has decayed.

Dimensions.—

Stem internode, length	0·59-1·19 mm.
,, ,, diameter	0·15-0·17 ,,
Hydroclade internode, length	0·44-0·50 ,,
Hydrotheca, depth (highest point to lowest)	0·31-0·33 ,,
,, diameter of mouth (side view)	0·19-0·21 ,,

Locality.—Entangled amongst Polyzoa from Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898.

The known distribution of this species is confined to Australian waters, and to the Natal coast.—Moncoeur Island, Bass Strait (Allman), Port Phillip and Griffith Point (Bale), and present record; Scottburgh, Natal (Warren).

HALICORNOPSIS ELEGANS (*Lamarck*).

(Plate lxxxix., fig. 1.)

Plumularia elegans, Lamarck, Histoire nat. des Animaux sans Vertèbres, 1816, p. 129.

Aglaophenia elegans, Lamouroux, Hist. polyp. corral. flexibles, 1816, p. 169.

Aglaophenia avicularis, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 33, pls. i. and iii., fig. 3.

Halicornopsis avicularis, Bale, Journ. Micro. Soc. Vict., ii., 1881, p. 14, pl. xiii., fig. 3. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 185, pl. x., figs. 1, 2, pl. xix., fig. 32. *Id.*, Bale, Trans. Roy. Soc. Vict., xxii., 1886, p. 101 (reprint p. 29). *Id.*, Marktanner-Turneretscher, Ann. K.K. Hofmus. Wien, v., p. 279.

Azygoplon rostratum, Allman, Rep. Sci. Results "Challenger" Exped., Zool., vii., 1883, p. 54, pl. xix., figs. 1-3.

Halicornopsis elegans, Billard, Ann. sci. nat., Zool. (9), v., 1907, p. 323. *Id.*, Billard, *Ibid.* (9), ix., 1909, p. 329.

Stations 36 and 48.

From a solitary locality come a few unfascicled fragments of a specimen belonging to this, when fully developed, fascicled species (*cf.* Kirchenpauer 1872, Bale 1886). While the descriptions of Allman (1883) and Bale (1884), with their accompanying characteristic figures, give account of the more salient features of the species—Allman's figure of a colony portraying with exactitude the very irregular mode of branching in our specimens —a few details have to be added.

A branch is set on a stout process which projects from the proximal end of an internode of the parent shoot, and which bears a whorl of three sarcothecæ near its distal end. The first branch-internode is longer than the remainder, and bears a single longitudinal series of four or five sarcothecæ on its adcauline surface, and a single hydroclade near its distal end. The remainder of the internodes are uniform, bearing two alternate hydroclades (occasionally only one), the proximal adcauline, the distal almost on the anterior surface of the internode. The base of each hydroclade is accompanied by three (not two, as Bale states, 1884, p. 186) sarcothecæ; two small scoop-shaped individuals, one on the anterior proximal portion of the basal process, the other on the internode, anterior and distal to the basal process; and the third, a larger canaliculate individual in the distal angle between hydroclade and branch (see Pl. lxxxviii., fig. 1). On long internodes, additional sarcothecæ may appear in the spaces between or beyond the hydroclades.

The structure of the hydrotheca is even more bizarre than authors have recorded. Although the cœnosarc of the specimens is in a very poor state of preservation, it was observed that the position of the hydranth in the hydrotheca is peculiar. The cœnosarc, instead of entering the hydrotheca at the base, proceeds

along what has been described as the basal portion of the mesial sarcotheca, and turning aside where a hammer-like projection of chitin partially blocks the direct passage, and marks the base of the mesial nematophore strictly speaking, enters the anterior portion of the hydrotheca. The base of the hydranth thus lies at the base of the large anterior tooth, and the hydranth when expanded must double round the free margin of the intrathecal ridge and bend backwards again towards the mouth of the hydrotheca.

A sarcostyle, which has passed unnoticed, issues from a median pore in the internode wall, in the angle behind the hydrotheca. Although it is unprovided with a special sarcotheca, it is sufficiently protected by the posterior portion of the hydrotheca, and by two expansions of the internode of unique character, which, on each side, rise above the node. The margin of these, curving forwards and downwards, merges at last with the lateral wall of the hydrotheca, almost opposite the issuing point of the supracalycine sarcostyle. *Gonosome* not present.

Dimensions.—

Hydroclade-bearing internode, length	1·06-1·78 mm.
,, ,, diameter	0·29-0·38 ,,
Hydroclade internode, length	0·40-0·45 ,,
,, ,, diameter	0·16 ,,
Hydrotheca, depth	0·22-0·25 ,,
,, diameter at mouth (lateral aspect)	0·25-0·28 ,,
,, diameter at mouth (frontal aspect)	0·32-0·36 ,,

Localities.—A fragment growing on the bare axis of an Isid Alcyonarian from Station 36, off Botany Bay, one mile from shore; depth, 23 to 20 fathoms; bottom, sand to rock; 11th March, 1898. A few fragments of a colony from Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898.

HALICORNARIA FURCATA, *Bale.*

(Plate lxxxvi., figs. 2, 3.)

Halicornaria furcata, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 178, pl. xiii., fig. 3, pl. xvi., fig. 5. *Id.*, Bale, Trans. Roy. Soc. Vict., xxii., p. 101 (p. 29 of reprint).

Stations 44 and 48.

Only a few colonies of this species have been found, the largest being a simple stem, 9 cm. high, another 7·5 cm. high, with a few dichotomously forked branches, and with long, anastomosed

rhizoidal tubes at base. The characters agree in detail with Bale's descriptions except that the few branchlets present show no sign of incurving towards each other at the tips.

As the following measurements show, there is a considerable amount of variation in the length of the free portion of the mesial sarcothecæ, these structures in general presenting a series which gradually increases in length from the proximal portion of a hydroclade towards its tip. In one case there was no terminal perforation in the mesial sarcotheca of a proximal hydrotheca. No *gonosome* was observed.

Dimensions.—

Hydroclade-bearing internode, length	0·74 0·78	mm.
,, ,, diameter	0·49-0·56	,,
Hydroclade internode, length	0·33-0·36	,,
,, ,, diameter	0·21-0·25	,,
Hydrotheca, depth[47]	0·21	,,
,, breadth[48]	0·18-0·20	,,
,, length of free portion of mesial sarcotheca	0·05-0·13	,,

Localities.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898; one unbranched colony, 9 cm. high. Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; two fragmentary branched colonies. Southern coast New South Wales; two colonies.

The specimens from Station 48 were at first sight indistinguishable from a colony of *Halicornaria thetidis*, along with which they were growing.

HALICORNARIA PROLIFERA (*Bale*).

(Plate lxxxv., figs. 2, 3.)

Aglaophenia prolifera, Bale, Journ. Micro. Soc. Vict., ii., 1882, p. 34, pl. xiv., fig. 5.

Halicornaria prolifera, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 183, pl. xiv., fig. 1, pl. xvi., fig. 10.

I regard as belonging to a variety of *Halicornaria prolifera* three monosiphonic, unbranched, simply pinnate colonies, the largest 17 cm. in height, which were associated with *Halicornaria furcata*. In the following points they differ from the specimens

[47] Measured from aperture to base along long axis of hydrotheca.

[48] At right angles to depth.

described by Bale (1884). The colonies are unbranched. The hydroclades, two on an internode, are sub-opposite, and arise from opposite sides of the internodes, so that they lie in one plane. The hydrothecæ are deeper, their long axis is more nearly parallel to that of the internode, and the aperture, therefore, faces more directly upwards. There is much variation in the prominence of the marginal teeth, which are in some cases almost obsolete, and which are never so prominent in anterior view as are those portrayed in Bale's figure (1884, pl. xvi., fig. 10). The margin, from the anterior aspect, seems to be almost circular. The mesial sarcothecæ are much shorter than those described by Bale, some failing to outreach the anterior hydrothecal tooth, although some, for there is much variation, overtop it for a considerable distance. In this character, our specimens appear to resemble those originally described by Bale (1882, see 1884, p. 184).

In other respects the specimens agree with Bale's description. I would add that on the first hydrotheca of each hydroclade, the mesial sarcotheca is distinctive, for it usually terminates, short of the margin of the hydrotheca, in a broad free lip which lies parallel to the anterior wall of the hydrotheca—the elemental type of sarcotheca from which, as can be seen in these specimens, tubular mesial sarcothecæ and tubular supracalycine sarcothecæ have developed.

Dimensions.—

Stem internode, length	0·57-0·60 mm.
,, ,, diameter	0·45-0·54 ,,
Hydroclade internode, length	0·26-0·31 ,,
,, ,, diameter	0·14-0·18 ,,
Hydrotheca, depth	0·21-0·22 ,,
,, breadth at mouth (lateral aspect)	0·16 ,,
,, length of free portion of mesial sarcotheca	0·05-0·13 ,,
Cauline sarcotheca, greatest width	0·11 ,,

Locality.—Southern coast of New South Wales.

The species is confined to the waters of South and East Australia.

HALICORNARIA THETIDIS,[49] *sp. nov.*

(Plate lxxxv., fig. 1; Plate lxxxix., figs. 3, 4.)

Stations 44 and 48.

Trophosome.—Two simply pinnate, unbranched, unfascicled colonies, the largest of which is 18 cm. high, were found at

[49] Named in honour of H.M.C.S. "Thetis."

Station 48. The stem is divided into internodes which fall roughly into two size-groups—those on the lower part of the stem which bear two hydroclades, and those on the distal part which, as a rule, bear only a single hydroclade each, and are about half the length of the former. The hydroclades are alternate, and are set on the anterior of the stem. They are divided into a series of regular internodes, each of which bears a solitary hydrotheca; but there are no internodal septa.

The hydrothecæ are set closely, but clear of each other. They are deep, oval in shape, and narrowing towards the base, the axis of the hydrotheca lying away from the hydroclade at an angle of about 40°. The margin is scalloped into seven very distinct teeth, of which the anterior is strongly developed and is recurved; while of the three which occur on each side, the abcauline two are bent outwards. The back is entire and free, almost on a level with the posterior teeth. There is no intrathecal ridge, but the aperture between the hydrotheca and the internode is guarded in front and in rear by a row of sharp denticles projecting into the hydrotheca. The median sarcotheca is adnate to the hydrotheca up to the base of the recurved anterior tooth, and thence curves upwards as a free tapering tube, which reaches half the height of the hydrotheca above the hydrothecal margin. It has two openings—a large aperture faces the hydrotheca, and the margin of the terminal opening is serrated as if it had been broken. The lateral sarcothecæ are adnate, saccate, roughly triangular in outline, with a broad free margin which never becomes tubular at the ends. Parallel to the margin, and a short distance within it, runs a chitinous ridge. There are three cauline sarcothecæ, which are large, and are similar to the laterals in shape. One, the smallest, lies at the anterior proximal end of the internode process, the others are distal—one on the anterior, and the other on the posterior of the internode. The distal anterior sarcothecæ of all the internodes lie almost in a straight line along the stem. *Gonosome.*—Unknown.

Dimensions.—

Stem internode, length	0·42-0·88 mm.
,, ,, diameter	0·52-0·67 ,,
Hydroclade internode, length	0·35-0·39 ,,
Hydrotheca, depth	0·31-0·34 ,,
,, breadth at mouth (lateral aspect)	0·21-0·22 ,,
,, length of free portion of mesial sarcotheca	0·12-0·21 ,,
Cauline sarcotheca, greatest width	0·19-0·22 ,,

This species most nearly approaches *Halicornaria prolifera*, from which it differs in the arrangement of its hydroclades

distinctly on the anterior of the stem, often only one on an internode. For the sake of comparison, the conditions of a hundred internodes of the two species were examined. In *Halicornaria prolifera*, as represented in this collection of one hundred internodes, ninety-nine bore a pair of hydroclades, one bore a solitary hydroclade; whereas in this species, reckoning from the distal end of the colony, two had three hydroclades, thirty-four a pair, while sixty-four had only a single individual. It also differs in the angle of its hydrotheca, and especially in the open non-tubular condition of its lateral sarcothecæ, and the similar condition, size, and relative position of the cauline sarcothecæ. The dimensions of the present species throughout are much larger.

Localities.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898; fragment. Station 48, off Wollongong, seven to eight miles from shore; depth, 55 to 56 fathoms; bottom, sand and mud to rock; 18th March, 1898; two colonies.

Type Specimens.—In the Australian Museum, Sydney.

CLADOCARPUS (?) BATHYZONATUS,[50] *sp. nov.*

(Plate lxxxix., figs. 2, 6-11.)

Station 57.

Only two colonies of this species were found associated with *Sertularella longitheca*.

Trophosome.—The habit of a colony is slight, for it consists of an unbranched slender stem up to 20 mm. in height, from the distal portion of which a few short, delicate hydroclades project. The stem is fascicled, the cladate tube being accompanied by a very few accessory tubes for the greater portion of its length, all the tubes forming, with their branches, a tangle of hydrorhiza at the base. None of the fascicle shows a trace of nodes, but the lower portion of the cladate tube, which for from 6 to 12 mm. is destitute of hydroclades, is furnished with a linear series of nematophores, twelve to fourteen in number. The distal portion bears short alternate hydroclades, those on the same side being separated by about 1 mm. Associated with the short projection from the internode, on which the hydroclades rest, is only one nematophore, which lies in the axil between its upper side and the stem; but in addition to this there occur on the anterior of the stem between two hydroclades, one, or more usually, two, cauline nematophores. The sarcothecæ of those nematophores

[50] *βαθύζωνος*, long-waisted.

are all similar, somewhat rectangular in shape, the upper corners of the rectangle being, as it were, clipped off so that the sarcostyles may issue by a pair of apertures. The hydroclades are divided into long regular internodes not more than seven in number, the greater part of each of which is occupied by a hydrotheca. The lower portion of an internode slightly overarches the hydrotheca of the preceding one, and the whole cavity is divided by very numerous (eleven to thirteen) septal ridges, two of which lie proximal to the hydrotheca.

The hydrothecæ are tubular, extremely deep and narrow, about four times as long as wide, approaching in this respect the bizarre *Cladocarpis tenuis*, Clarke. Their anterior profile is somewhat S-shaped, narrower at the middle, a long inward curve dividing the hydrotheca into two portions, and giving rise to the specific name signifying "long-waisted." The margin of the hydrotheca is horizontal and is furnished with a single, anterior, flame-shaped tooth, the remainder being very minutely and irregularly crenate. Across the base of the hydrotheca, stretching from the lower end of the posterior wall to a minute knob of chitin on the anterior wall is a chitinous septum perforated to allow the passage of the cœnosarc which connects the hydranth with the common cœnosarc of the colony. On the hydrothecal side this opening is guided by an offshoot of the basal septum which forms a short tongue of chitin bending over it, and resembles a diminutive intrathecal ledge (Pl. lxxxix., fig. 7).

The sarcothecæ are characteristic when mature. The supracalycine are large, and for almost half their height overtop the margin of the hydrotheca. In all cases, they possess two apertures, one terminal, the other latero-adcauline (Pl. lxxxix., fig. 7). Frequently, however, the terminal aperture has lost its general circular shape, and has become elongated, exactly resembling that of the sarcothecæ of *Cladocarpus distomus*, Clarke.[51]

This transverse slit-like opening advances a stage further by the growth of its bordering walls, and by the consequent narrowing of the middle portion of the slit. The approaching walls eventually meet, and the slit is divided into two distinct apertures. Where such a process has occurred, the supracalycine sarcotheca has three apertures, but occasionally one of the terminal openings again seems to elongate and become divided, so that four (three of them "terminal") are sometimes present (Pl. lxxxix., fig. 7, lower hydrotheca). Only one of the apertures

[51] S. F. Clarke—Reports of the Sci. Res. Exped. to Eastern Tropical Pacific by "Albatross," viii., The Hydroids—Mem. Mus. Comp. Zool. Harvard, xxxv., No. 1, 1907, p. 17, pl. xiv., figs, 6, 7, and 10.

is strictly terminal, the remainder lying on the exterior ridge of the sarcotheca, and being directed backwards.

A similar development occurs in the median sarcotheca, which is short and stout, projecting outwards and upwards parallel to the hydrotheca wall, from which it is altogether free. In its simplest form, it possesses two openings, one terminal, the other at its base facing towards the hydrotheca. But the terminal opening may become slit-like, and, by the median closing of the slit, two apertures may be formed. These, developing become quite distinct, and the median sarcotheca appears to be bifurcated (Pl. lxxxix. figs. 8, 9, 10, 11). The abcauline wall of the hydrotheca is continued half-way across the base of the mesial sarcotheca as an S-shaped process. The cauline sarcothecæ have already been described. *Gonosome.*—Unknown.

Dimensions.—

Stem, cladate tube, diameter	0·087-0·099	mm.
Hydroclade, internode, length	0·73-0·78	,,
Hydrotheca, depth	0·52-0·57	,,
,, diameter at "waist," side view	0·14	,,
,, diameter at mouth, side view	0·21	,,
,, diameter at "waist," front view	0·10-0·11	,,
,, diameter at mouth, front view	0·21	,,

Affinities.—Owing to the absence of the gonosome, I am unable to give this species its definite generic rank. Its relationships are, however, apparently with those elongated, multiseptate species of *Cladocurpus* and *Aglaophenopsis* which have hitherto been found only in American waters. It approaches *Cladocarpus tenuis*, Clarke,[52] differing at least in the structure of its sarcothecæ, the robustness and proximity of its hydrothecæ, in the more definite arrangement of the internodal septa, in the absence of nodes in the stem, and possibly in having its stem fascicled. There seems to me also to be a close relationship between this species and *Cladocarpus distomus*, Clarke, from the Eastern Pacific, near Panama, in spite of the fact that no internodal septa occur in the latter and that an additional nematophore is present on each internode.

It is interesting to note that Plumularians of this elongated type have hitherto been found only in American waters.

Locality.—Station 57, off Wata Mooli, three and a half to four miles from shore; depth, 59 to 54 fathoms; bottom, mud; 22nd March, 1898.

Type Specimens.—In the Australian Museum, Sydney.

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[52] S. F. Clarke—Reports on the Dredging Operations of the "Blake"—Hydroida: Bull. Mus. Comp. Zool. Harvard, v., p. 247, pl. v., figs. 31, 31*b*.

AGLAOPHENIA CRUCIALIS, *Lamouroux.*

(Plate lxxxvi., fig. 1.)

Aglaophenia crucialis, Lamouroux, Hist. polyp. corral. flexibles, 1816, p. 169. *Id.*, Kirchenpauer, Abh. Ver. Hamburg, v., 1872, p. 26 (but not pl. i., fig. 8). *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 168 (but not pl. xviii., fig. 8). *Id.*, Billard,(1) Compte Rendu Acad. Sci., cxlviii., 1909, p. 1063. *Id.*, Billard,(2) Ann. Sci. Nat., Zool. (9), ix., 1909, p. 331.

Anisocalyx crucialis, Costa, Fauna del regno di Napoli. Zoofiti Napoli, 1838, p. 19.

Plumularia crucialis, Blainville, Man. d'actinol. ou de zoophytol., 1834, p. 478.

Aglaophenia macrocarpa, Bale, Proc. Linn. Soc. N. S. Wales (2), iii., 1888, p. 791, pl. xxi., figs. 3, 4.

{Not *Thecocarpus crucialis*, Billard, Ann. Sci. Nat., Zool. (9), v., 1907, p. 328, fig. 3).

Stations 44, 47, 48, and 55.

Trophosome.—The general habit of this species being little known, owing to the deficient descriptions of earlier writers, the fragmentary nature of Bale's (1888) specimens, and the young state of the colony, a pencil drawing of which, by Lamouroux, has been recently described by Billard, 1909(2), I give a description of a fine colony collected by the "Thetis." This colony, which is 24 cm. high, consists of a main stem, 4 mm. in diameter at the base, expanding downwards into a contorted root-mass, 3 cm. long. The lower portion of the stem is destitute of hydroclades and is covered by extraneous growths, but at 7 cm. from the base of the stem branching begins. The primary branches are set in opposite pairs on the anterior of the stem from which they project almost at right angles. Each lateral series lies by itself in a single plane; but this is not the case with the two series, for the tips of the branches are always inclined towards the anterior, although in such a way that the planes containing the respective series meet at a wide angle. There are seven pairs of primary branches, the largest of which has a diameter at the base of 1 mm. and a length of 82 mm. Such a branch may bear secondary branches up to 47 mm. long, and this again, branches of third degree, 17 mm. long. The distance between primary pairs of branches varies from 15 to 24 mm., that between secondary pairs is about 15 mm. Remarkably fine as this colony is, its size could have been nothing to that of one represented by

a fragment from Station 47. Only 11 cm. of the stem remains, but its basal diameter is 9·5 mm.; of its two primary branches the only complete one is 300 mm. long, while a secondary branch is 125 mm.

There is little to be added to Bale's (1888) excellent description of the minute characters of the trophosome. The branches arise from the hydrocladiate tube of the colony, which is anterior, and have several simple internodes with solitary hydrothecæ, before a hydroclade-bearing internode is reached. In the hydrotheca itself there occurs an undescribed knot of chitin, varying considerably in prominence as seen in lateral aspect, which juts into the hydrotheca cavity from the abcauline wall, very near to the bottom of the cup. The margin of the hydrotheca varies considerably, the characteristic broad lateral lobe especially exhibiting stages of decrease in size, so that in some specimens it has become almost obsolete.

Gonosome.—The corbulæ are of great length, up to 10 mm., and a little over 1 mm. in diameter. Those which I have seen are closed, except for a space between the bases of the leaflets such as Bale has described. Here, however, the margins of the leaflets frequently rise into very pronounced crests, bordered on the outer edge by about ten sarcothecæ, and rising so far above the body of the corbula that the inner edge also becomes free and is supplied with three or four sarcothecæ. The short lateral spur which projects outwards and forwards from the stalk of each leaflet is also better developed, for here it has become an accessory leaflet armed with up to seven sarcothecæ. The general structure of the body of the corbula is that of a cylinder encased within a cylinder, the inner cavity containing the reproductive bodies, the space between the two cylinders (formed of the two walls of the corbula leaflets), containing cœnosarc which is in free communication with the exterior through the sarcothecæ.

Dimensions.—

Organs.	Typical form.	Variety from Station 55.
Hydroclade-bearing internode, length	0·36 mm.	0·25-0·32 mm.
,, ,, diameter ...	0·29 ,,	0·38-0·42 ,,
Hydrothecate internode, length.....	0·32-0·41 mm.	0·31-0·34 ,,
Hydrotheca, depth	0·27-0·34 ,,	0·29-0·31 ,,
,, diameter at mouth.....	0·18 ,,	0·21 ,,
Hydroclade, length	up to 13 ,,	up to 13 ,,
Corbula, length	up to 10 ,,	?
,, diameter	about 1 ,,	?

A variety occurs at Station 55 in which the hydroclades are more closely set; the hydroclade internodes, and therefore the

hydrothecæ, are more dumpy ; the anterior tooth is broader and more strongly developed, and the supracalycine sarcothecæ have frequently a very wide aperture (see table of dimensions).

Remarks.—The synonymy of this species, confounded from early times by erroneous identification with *Plumularia brachiata*, Lamarck, has been elucidated by the recent examination of the type specimens of these two species, undertaken by Dr. Billard. This makes necessary the disappearance of Bale's *Aglaophenia macrocarpa* which is a synonym.

Localities.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms ; bottom, fine sand ; 15th March, 1898 ; small fragment of colony. Station 47, off Bulgo, six to eight and a half miles from shore ; depth, 63 to 57 fathoms ; bottom, mud and abattoir refuse ; 16th March, 1898 ; fragment of very large colony. Station 48, off Wollongong, seven to eight miles from shore ; depth, 55 to 56 fathoms ; bottom, sand and mud to rock ; 18th March, 1898 ; many fragments, with corbulæ. Station 55, off Crookhaven River, one mile from shore ; depth, 15 to 11 fathoms ; bottom, sand to rock ; 20th March, 1898 ; fragment. Southern Coast, N. S. Wales ; one fine colony.

Aglaophenia crucialis has been obtained only from Australian seas, from which indefinite locality Lamarck recorded it. Bale's record is from "off Port Jackson" (1888, p. 792).

AGLAOPHENIA DIVARICATA (*Busk*).

Plumularia divaricata, Busk, Voy. "Rattlesnake," i., 1852, p. 398.

Plumularia ramosa, Busk, *Op. cit.*, p. 398.

Aglaophenia ramosa, Kirchenpauer, Abh. ver. Hamburg, v., 1872, p. 38, pls. i. and ii., fig. 17.

Aglaophenia McCoyi, Bale, Journ. Micro. Soc. Vict., ii., 1882, p. 36, pl. xiv., fig. 2.

Lytocarpus ramosus, Allman, Journ. Linn. Soc., Zool., xix., 1886, p. 154, pl. xxv., figs. 1-3.

Aglaophenia divaricata, Kirchenpauer, *Op. cit.*, p. 26. *Id.*, Bale, Cat. Austr. Hydroid Zoophytes, 1884, p. 162, pl. xv., figs. 7, 8, pl. xvii., figs. 6, 7. *Id.*, Billard, Compte Rendu Acad. Sci., cxlviii., 1909, p. 368.

Station 54.

The collection contains only a young colony, and a fragment of a larger one, neither of which bear corbulæ. Each hydroclade

branch commences with a series of about six athecate internodes, bearing a single median sarcotheca on the anterior surface.

Dr. Billard regards *Aglaophenia acanthocarpa* and *Aglaophenia laxa*, both described by Allman,[53] as identical with *Aglaophenia divaricata*. With this opinion I cannot agree; for Allman has described the presence of, and has figured very distinctly "an imperfect septum continuous with the intrathecal ridge, and another oblique septum at the base of the lateral nematophores" (p. 274) in *Aglaophenia acanthocarpa;* and "three distinct diaphragms—one of which is a continuation of the intrathecal ridge, one at the base of the lateral nematophores, and one at the base of the hydrotheca" (p. 276) in *Aglaophenia laxa*. But one of the most characteristic features of *Aglaophenia divaricata*, as portrayed by Bale and as exhibited in the specimens collected by the "Thetis," is the large size of the supracalycine nematophores, which reaching downwards to the middle of the hydrotheca, bring it about that the septum at their base and that opposite the intrathecal ridge are one.

Other features distinctive of this species are the very strong chitinous ledge which projects into the hydrotheca, and on which the more delicate intrathecal ridge rests, and the absence of a bounding wall between the lower half of the hydrotheca and the internode. *Gonosome* not present.

Dimensions.—

Hydroclade-bearing internode, length	0·26-0·31 mm.
,, ,, ,, diameter	0·22-0·28 ,,
Hydroclade internode, length	0·24-0·26 ,,
,, ,, diameter	0·14-0·15 ,,
Hydrotheca, depth	0·165 ,,
,, breadth at mouth[54]	0·15-0·18 ,,

Locality.—Station 54, within Jervis Bay; depth, 10 to 11 fathoms; bottom, seaweed and sand; 20th March, 1898.

Order STYLASTERINA.

Family STYLASTERIDÆ.

STYLASTER EXIMIUS, *Saville Kent.*

Stylaster elegans, Duchassaing and Michelotti, Suppl. Mem. Coral. des Antilles—Mem. Acad. Sci. Turin (ii.), xxiii., 1864, p. 68, pl. ix., fig. 4. (Name preoccupied, renamed).

[53] Allman—Journ. Linn. Soc., Zool., xii., 1876, pp. 274-276, pl. xxiv.
[54] Distance from posterior wall to anterior tooth.

Stylaster eximius, Saville Kent, Proc. Zool. Soc., 1871, p. 278. *Id.*, Hickson and England, Siboga Expeditie, Mon. viii., 1904—The Stylasterina, p. 9, pl. 1, figs. 1-8.

Stylaster duchassaingi, Pourtalès, Ill. Cat. Mus. Comp. Zool. Harvard, Deep-Sea Corals, 1871, p. 35, pl. vi., figs. 1, 2. *Id.*, Mosley, Rep. Sci. Res. "Challenger" Exped., Zool., ii., 1881, pp. 81, 87.

Stations 44, 47, and 48.

Several colonies have been referred to this species. The majority occur growing upon the bare horny axis of an Alcyonarian, and are represented only in part. One markedly flabellate colony has a width of as much as 90 mm., while the tallest fragment is 65 mm. high, and has a diameter of 4·5 mm. at the base. The number of dactylozooids in a cyclosystem, judged by the septa, is smaller than in most species of *Stylaster*, varying from eight to eleven or twelve, and rarely to even fourteen. The cyclosystems are in general bilaterally symmetrical, the lower lip bracket-shaped and projecting, the upper with very few septal divisions. They are often almost crescentic in shape, the long axis lying across the direction of the branch. Ampullæ are plentiful in most of the colonies. The colour is a creamy-white, faintly tinged with varying densities of brown. The specimens approach most closely the facies *altus*, Hickson and England.

Note on Synonymy.—The designation *Stylaster elegans*, Duchassaing and Michelotti (1864), having been found to be preoccupied, the species was renamed in 1871, independently by Saville Kent—*S. eximius*—and by Count Pourtalès—*S. duchassaingi*. The proper specific name is dependent upon which of those designations is prior in time of publication. Mosley, in the "Challenger" Reports (1881), adopted the *S. duchassaingi* of Count Pourtalès, while Professor Hickson and Miss England in 1904 followed the *S. eximius* of Kent, placing in brackets after the reference to Kent's paper the date 4th April, 1871, presumably in justification of their change of name. From our point of view, however, this date has no significance, for it records the date only of the reading and not of the publication of Kent's paper. The question of priority seemed, therefore, to be still in abeyance. I have to thank Dr. P. Chalmers Mitchell, Secretary of the Zoological Society of London, and Dr. Samuel Henshaw, Curator of the Museum of Comparative Zoology, Harvard, for information which finally decides this question. According to the former, Kent's paper was published in the "Proceedings of the Zoological Society of London" on 16th August, 1871; according to the latter, that of Pourtalès was published on 30th October, 1871. The species must therefore be known as *Stylaster*

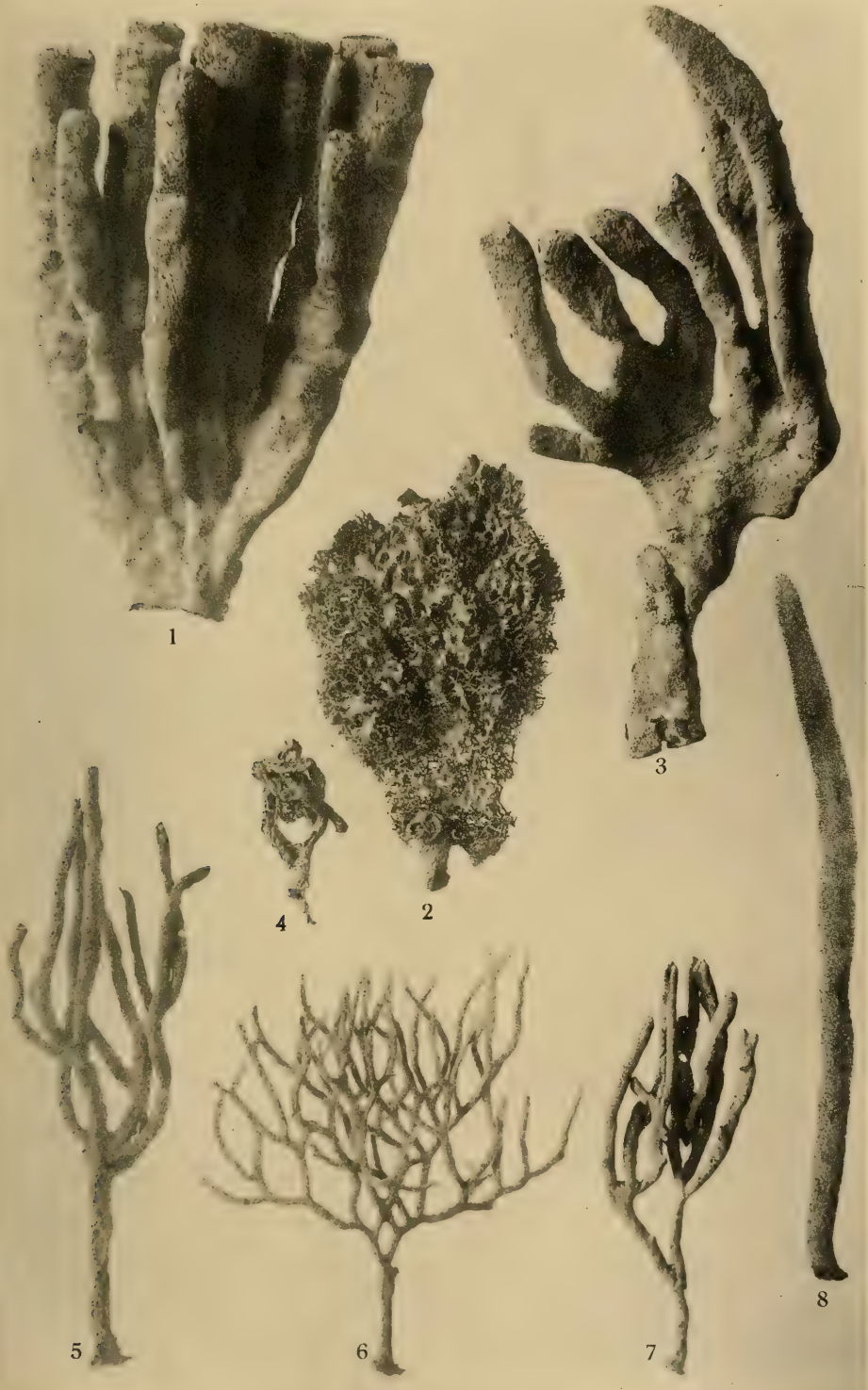
eximius, Kent, of which *S. duchassaingi* must be regarded as a synonym.

Localities.—Station 44, off Coogee, five to six miles from shore; depth, 49 to 50 fathoms; bottom, fine sand; 15th March, 1898. Station 47, off Bulgo, six to eight and a half miles from shore, depth, 63 to 57 fathoms; bottom, mud and abattoir refuse; 16th March, 1898. Station 48, off Wollongong; depth, 55-56 fathoms; bottom, sand and mud. Between Port Jackson and Tuggerah, N. S. Wales.

EXPLANATION OF PLATE XLIII.

Fig. 1.—*Chondropsis syringianus*, Whitelegge.
Fig. 2.—*Esperella textilis*, Whitelegge.
Fig. 3.— ,, *ancorina*, Whitelegge.
Fig. 4.—*Rhaphisia ramosa*, Whitelegge.
Fig. 5.—*Desmacidon porifera*, Whitelegge.
Fig. 6.—*Esperiopsis cylindrica*, Ridley and Dendy.
Fig. 7.— ,, *canaliculata*, Whitelegge.
Fig. 8.—*Esperella cylindrica*, Whitelegge.

(All the figures are about one-third natural size.)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EXPLANATION OF PLATE XLIV.

Fig. 9.—*Yvesia commensalis*, Whitelegge.
Fig. 10.—*Desmacidon* (?) *arenosa*, Whitelegge.
Fig. 11.— ,, *stelligera*, Whitelegge.
Fig. 12.—*Phelloderma polypoides*, Whitelegge.
Figs. 13-13*a*.—*Cladorhiza waitei*, Whitelegge.
Fig. 14.—*Desmacidon fruticosa*, Bowerbank.
Fig. 15.—*Dendoryx pumicea*, Whitelegge.
Fig. 16.—*Desmacidon conulissima*, Whitelegge.
Fig. 17.— ,, *hispidosa*, Whitelegge.
Fig. 18.—*Iotrochota arbuscula*, Whitelegge.

(All the figures are about one-third natural size.)

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T. WHITELEGGE, Photo.

EXPLANATION OF PLATE XLVI.

Fig. 31.—*Desmacidon porifera*, Whitelegge.
Fig. 32.—*Axinella frondula*, Whitelegge.
Fig. 33.— ,, *symbiotica*, Whitelegge.
Fig. 34.—*Clathria calopora*, Whitelegge.
Fig. 35.—*Raspailia, sp.*
Fig. 36.— ,, *dichotoma*, Whitelegge.
Fig. 37.— ,, *echinata*, Whitelegge.
Fig. 38, 38a.—*Microciona clathrata*, Whitelegge
Fig. 39.—*Sigmaxinella mammillata*, Whitelegge.
Fig. 40.—*Amphilectus munitus*, Whitelegge.
Fig. 41.—*Phakellia multiformis*, Whitelegge.
Fig. 42.—*Sigmaxinella dendroides*, Whitelegge.
Fig. 43.—*Axinella vermiculata*, Whitelegge.
Fig. 44.—*Higginsia scabra*, Whitelegge.
Fig. 45.—*Spongosorites variabilis*, Whitelegge.

(All the figures are about one-third natural size.)

T. WHITELEGGE, Photo.

EXPLANATION OF PLATE XLVII.

CRINOIDEA.

Oligometra thetidis.

Fig. 1.—First pinnule. × 5.

Fig. 2.—A pinnule from middle of arm. × 5.

Fig. 3.—A cirrus. × 5.

Himerometra pædophora.

Fig. 4.—First pinnule. × 10.

Fig. 5.—Second pinnule. × 10.

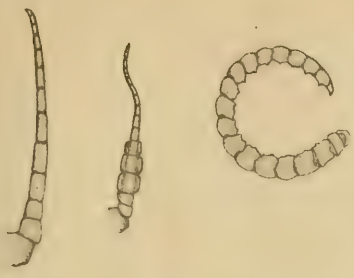
Fig. 6.—A distal pinnule. × 10.

Fig. 7.—Youngest pentacrinoid larva. × 35.

Fig. 8.—Pentacrinoid larva. × 35.

Fig. 9.—Old pentacrinoid larva. × 35.

Fig. 10.—A cirrus. × 10.



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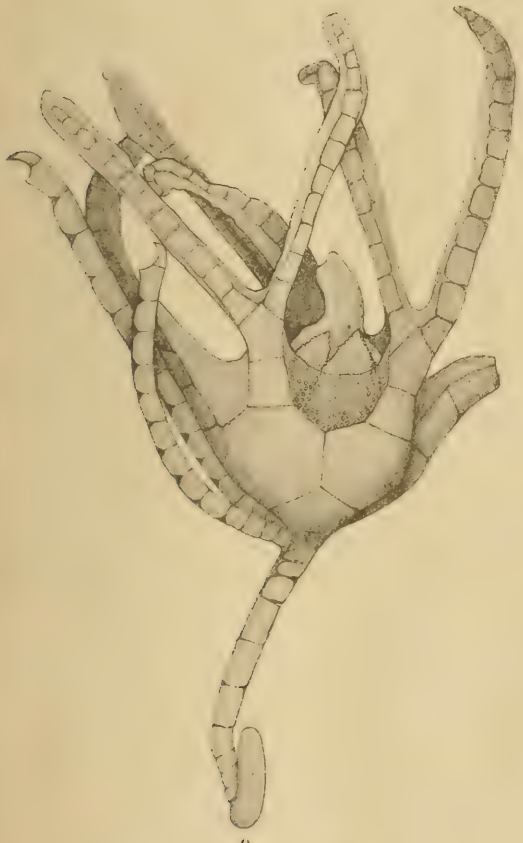

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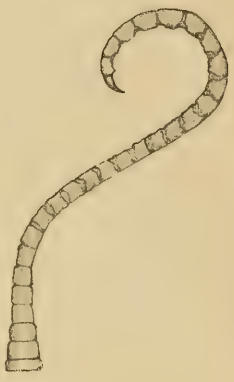

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H. L. CLARK, Del.

EXPLANATION OF PLATE XLVIII.

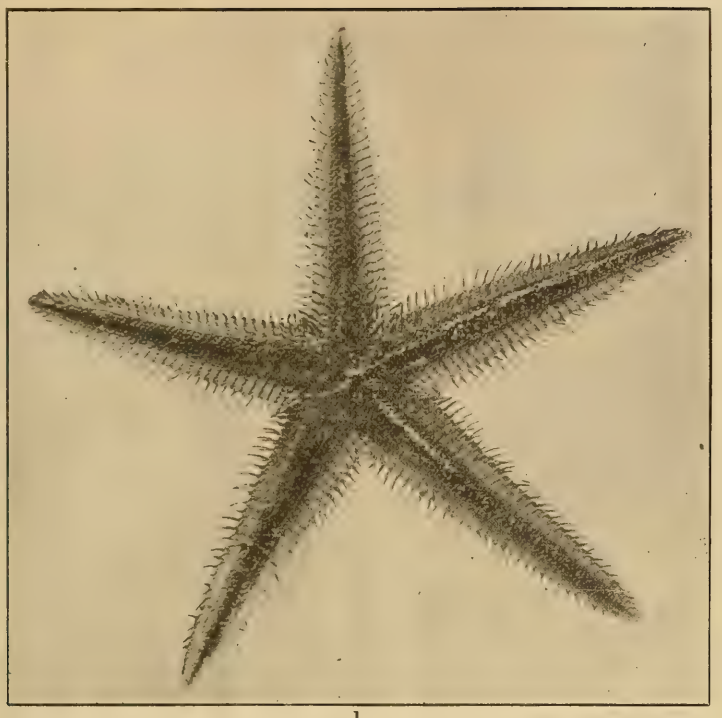
ASTEROIDEA.

Astropecten pectinatus.

Fig. 1.—Full-grown animal.

Fig. 2.—The same, lower side.

One half natural size.



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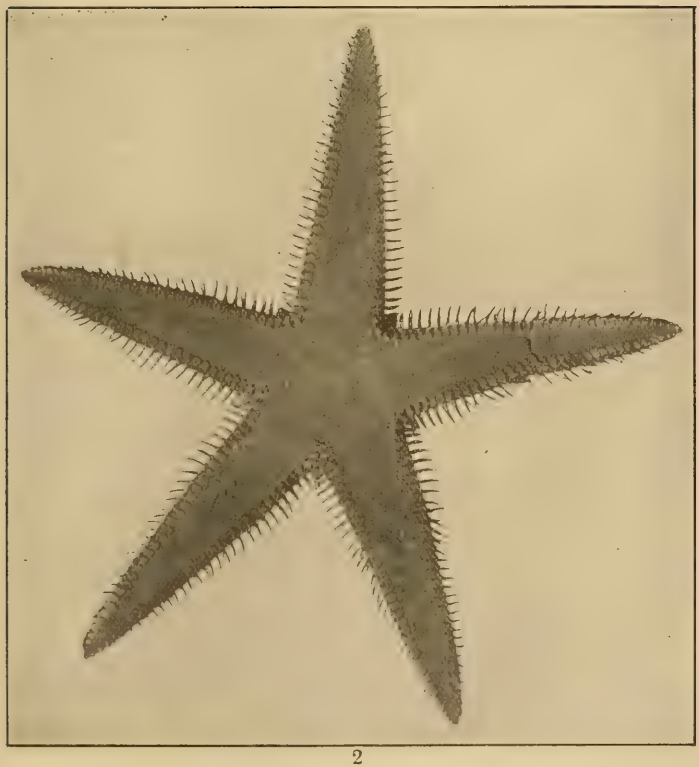

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A. R. McCULLOCH, Photo.

EXPLANATION OF PLATE XLIX.

ASTEROIDEA.

Henricia heteractis.

Fig. 1.—Full-grown animal. × 1½.

Fig. 2.—An adambulacral plate with its armature. × 20.

Coscinasterias dubia.

Fig. 3.—Large pedicellaria from disc. × 70.

Fig. 4.—Small pedicellaria from a wreath around one of the dorsal spines. × 70.

OPHIUROIDEA.

Pectinura dyscrita.

Fig. 5.—Side view of three arm-joints. × 5.

Fig. 6.—Abactinal view. × 5.

Fig. 7.—Actinal view. × 5.

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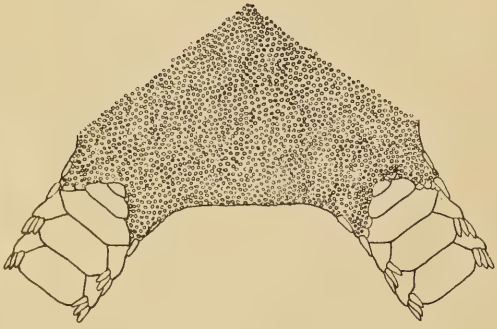

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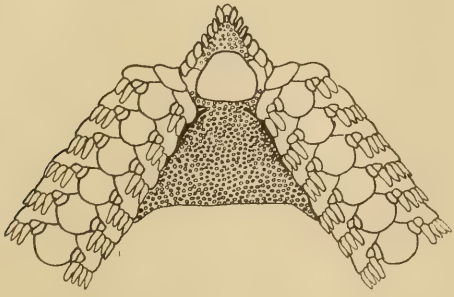

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A. R. McCULLOCH, Photo.
H. L. CLARK (figs. 2-4) and VIOLET DANDRIDGE (figs. 5-7), Del.

EXPLANATION OF PLATE L.

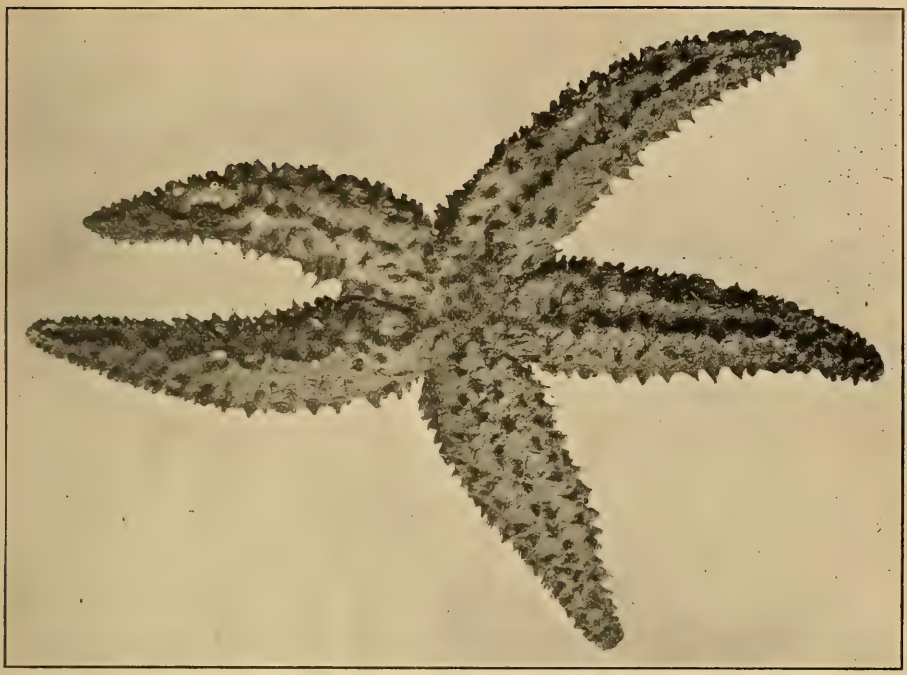
ASTEROIDEA.

Coscinasterias dubia.

Fig. 1.—Abactinal view.

Fig. 2.—Actinal view.

Two-thirds natural size.



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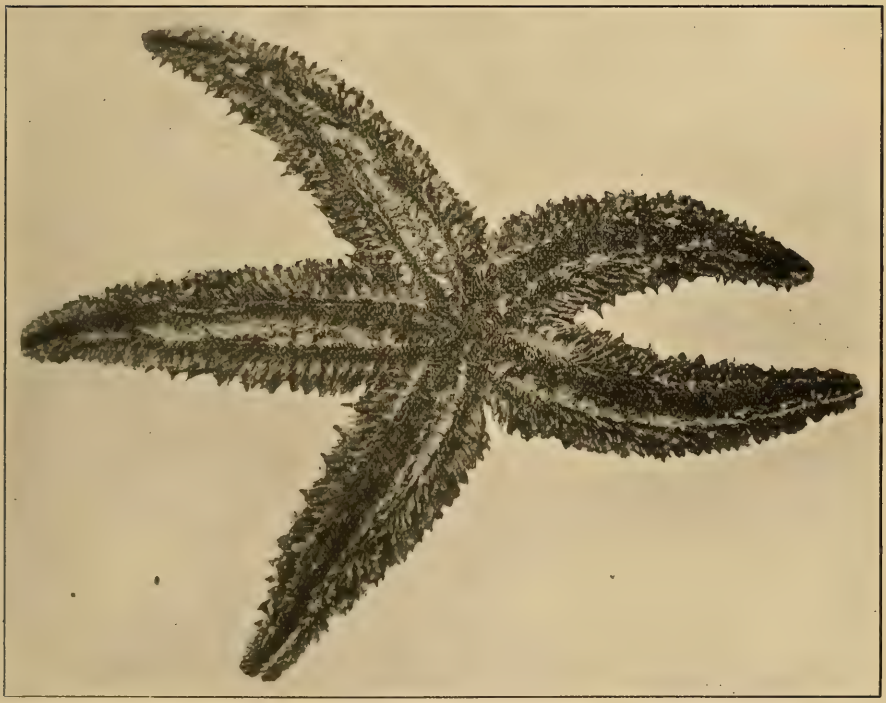

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A. R. McCULLOCH, Photo.

EXPLANATION OF PLATE LI.

OPHIUROIDEA.

Ophiozoua gymnopora.

Fig. 1.—Actinal view. × 15.

Fig. 2.—Abactinal view. × 15.

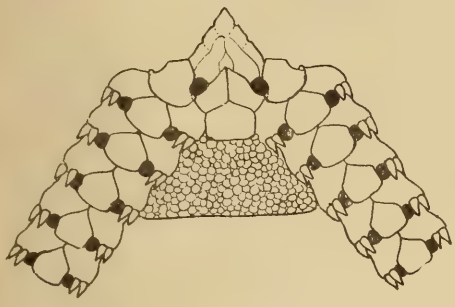
Fig. 3.—Side view of three arm-joints. × 15.

Ophiura ctenophora.

Fig. 4.—Actinal view. × 4.

Fig. 5.—Abactinal view. × 4.

Fig. 6.—Side view of base of arm. × 4.



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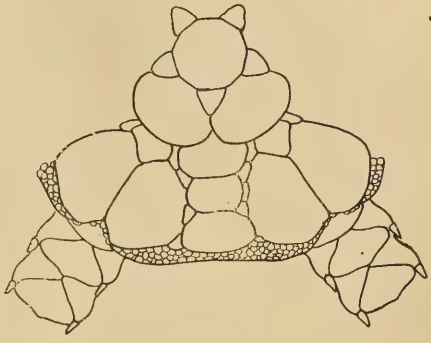

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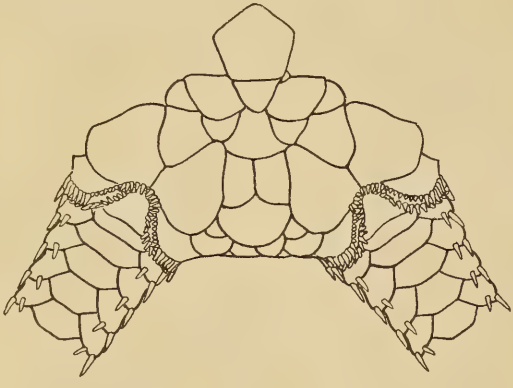

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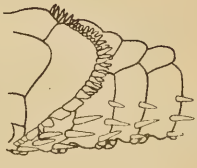


6

EXPLANATION OF PLATE LII.

OPHIUROIDEA.

Amphipholis australiana.

Fig. 1.—Actinal view. × 16.

Fig. 2.—Abactinal view. × 16.

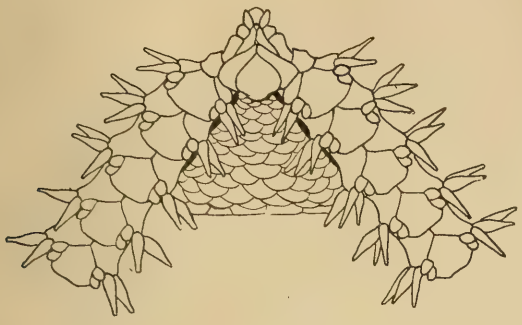
Fig. 3.—Side view of two arm-joints. × 16.

Ophiacantha heterotyla.

Fig. 4.—Actinal view. × 14.

Fig. 5.—Abactinal view. × 14.

Fig. 6.—Side view of second and third arm-joints. × 14.



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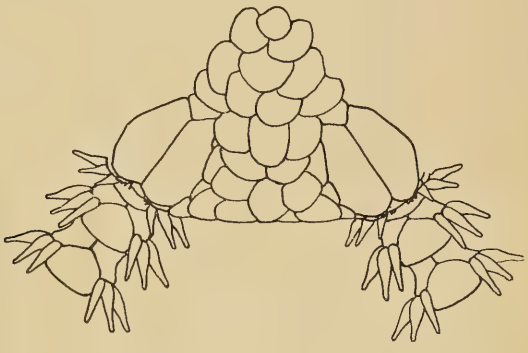

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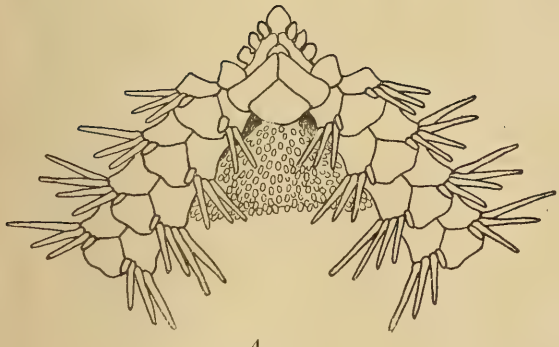

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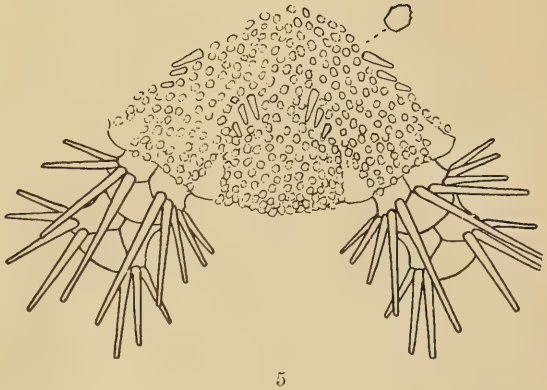


5

EXPLANATION OF PLATE LIII.

OPHIUROIDEA.

Ophiopristis axiologus.

Fig. 1.—Actinal view. × 15.

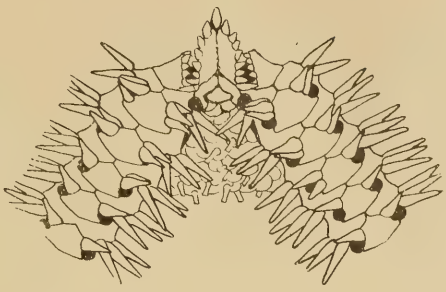
Fig. 2.—Abactinal view. × 15.

Fig. 3.—Side view of three arm-joints. × 15.

Ophiothrix acestra.

Fig. 4.—Abactinal view of disc and arm bases. × 7, with some of the disc-stumps and spinelets more highly magnified.

Fig. 5.—Ventral view of three arm-joints. × 7.



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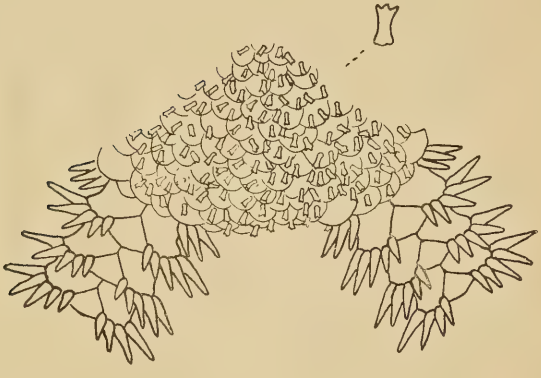

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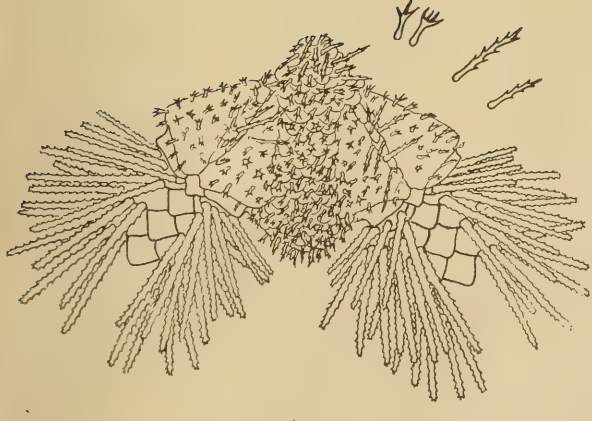

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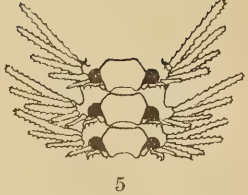


5

EXPLANATION OF PLATE LIV.

ECHINOIDEA.

Stephanocidaris bispinosa.

Fig. 1.—Side view. Slightly reduced.

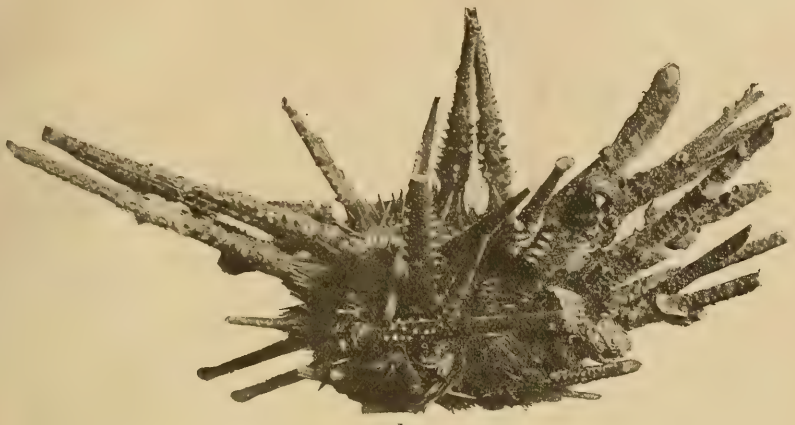
OPHIUROIDEA.

Astroporpa australiensis.

Fig. 2.—Abactinal view. × $2\frac{1}{2}$.

Astrothrombus rugosus.

Fig. 3.—Abactinal view of disc and bases of the five arms. × 6.



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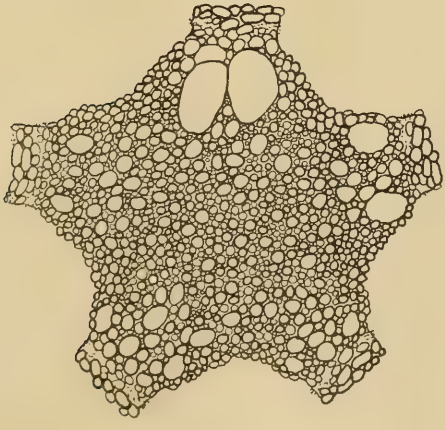

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VIOLET DANDRIDGE, Del.

EXPLANATION OF PLATE LV.

OPHIUROIDEA.

Conocladus amblyconus.

Fig. 1.—Side view. × $2\frac{1}{2}$.

Fig. 2.—Abactinal view. × $2\frac{1}{2}$.

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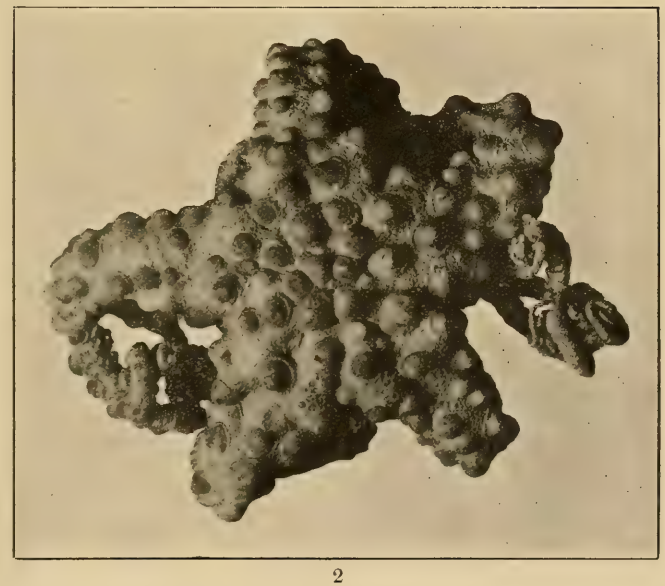

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A. R McCULLOCH, Photo.

EXPLANATION OF PLATE LVI.

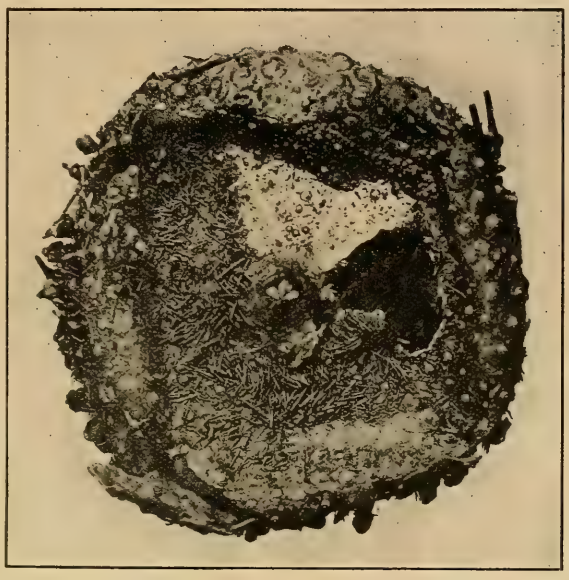
ECHINOIDEA.

Chætodiadema tuberculatum.

Fig. 1.—Actinal view.

Fig. 2.—Abactinal view.

Slightly enlarged.



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A. R. McCULLOCH, Photo.

EXPLANATION OF PLATE LVII.

ECHINOIDEA.

Chætodiadema tuberculatum.

Fig. 1.—Actinal view of an interambulacrum and an ambulacrum; natural size.

Fig. 2.—A "claviform pedicellaria." × 70.

Fig. 3.—A triphyllous pedicellaria. × 70.

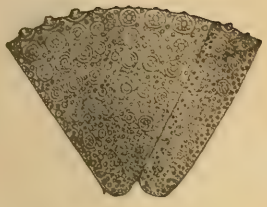
Fig. 4.—Valve of a triphyllous pedicellaria. × 70.

Fig 5.—A tridentate pedicellaria. × 70.

Fig. 6.—Valve of same. × 70.

Fig. 7.—Same as fig. 6, seen from side. × 70.

Fig. 8.—A very large pedicellaria, incompletely developed × 70.



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H. L. CLARK, Del.

EXPLANATION OF PLATE LVIII.

ECHINOIDEA.

Fibularia nutriens.

Fig. 1.—An ophicephalous pedicellaria. × 400.

Fig. 2.—Another, open, from another point of view. × 400.

Fig. 3.—Valve of a tridentate pedicellaria × 400.

Fig. 4.—Tip of a spine. × 400.

Fig. 5.—A female, natural size, from above.

Fig. 6.—The same. × 8.

Fig. 7.—Another from the side. × 8.

Fig. 8.—The same as fig. 7, from below. × 8.

Fig. 9.—A male, from above. × 8.

Fig. 10.—Interior view, abactinal half of test removed, showing intestine and lantern in position. × 8.

Fig. 11.—The same, with intestine and lantern removed, to show mouth and auricles. × 8.

HOLOTHURIOIDEA.

Molpadia dissimilis.

Figs. 12-15.—Calcareous tables from body wall; four discs, and a spire seen from the side. × 70.

Figs. 17-21.—Tables from the caudal appendage; four discs, and a spire seen from the side. × 70.

Molpadia productamensis.

Figs. 22-26.—Calcareous tables from body wall; three discs, and two spires seen from the side. × 70.

Figs. 27-30.—Tables from caudal appendage; three discs, and a spire seen from the side. × 70.

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H. L. CLARK, Del.

NOTICE.

The Plates belonging to Mr. Stebbing's Paper on Amphipoda follow after Plate No lviii., and are numbered xlvii.* to lx.*

EXPLANATION OF PLATE XLVII.*

A.

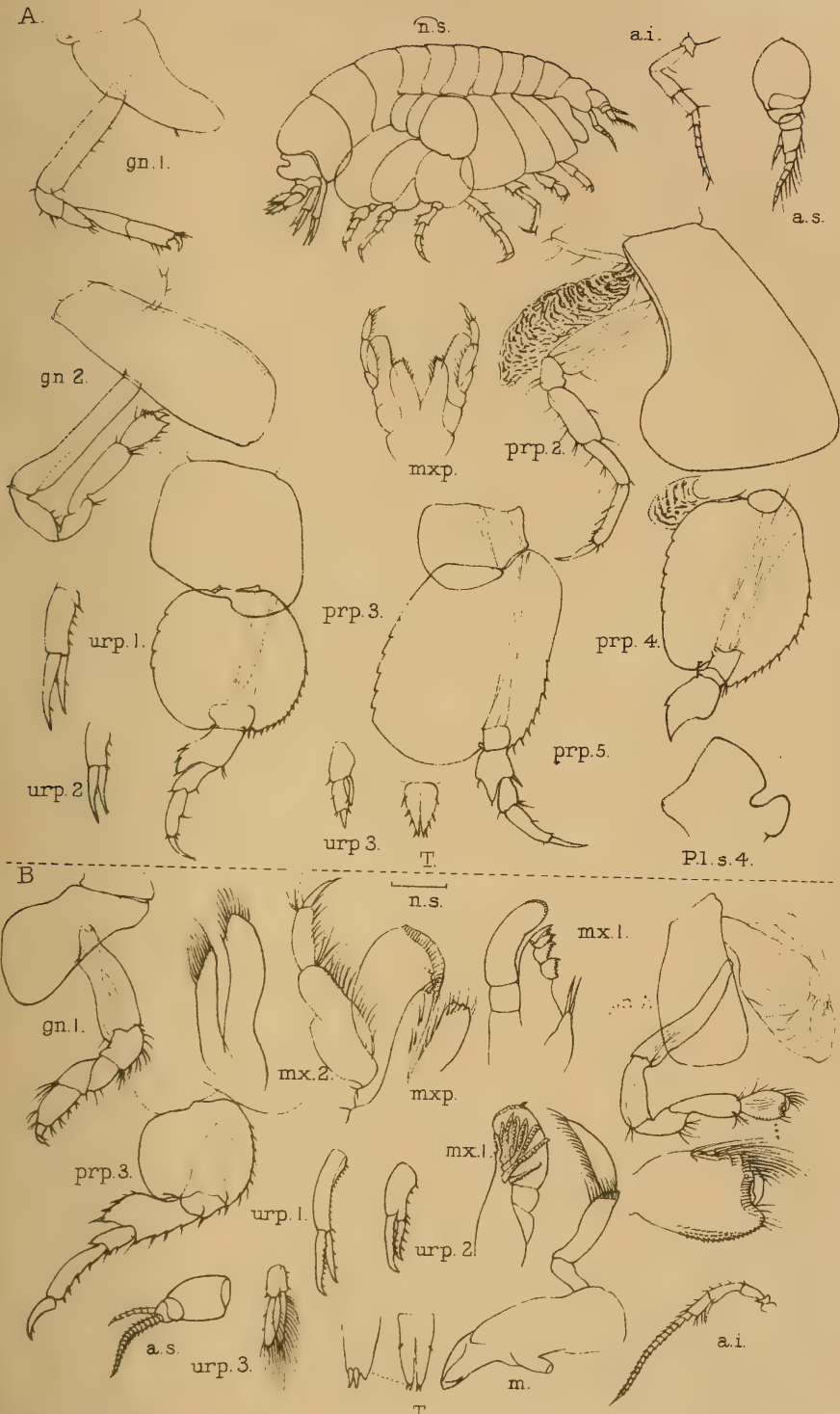
Tryphosa camelus, sp.nov.

n.s.—Line indicating natural size of specimen figured below.
a.s., *a.i.*—First and second antennæ.
mxp.—Maxillipeds.
gn. 1, *gn.2.*—First and second gnathopods.
prp. 2, *3*, *4*, *5*—Second, third, part of fourth, and fifth peraepods.
Pl. s. 4.—Profile of fourth pleon segment.
urp. 1, *2*, *3.*—First, second and third uropods.
T.—Telson.
All the details are drawn to a uniform scale.

B.

Waldeckia chevreuxi, sp.nov.

n.s.—Line indicating natural size of specimen from which the details are figured.
a.s., *a.i.*—First and second antennæ.
m. mx. 1, *mx. 1*, *mx. 2*, *mxp.*—One of the mandibles; one of the first maxillæ showing breadth of spines, the other member of the pair figured below showing the spines edgewise, the apex of the palp full face, the inner plate concealed; the maxillipeds, with outer plate and palp of one side omitted.
gn. 1, *gn. 2.*—First and second gnathopods, with further enlargement of hand and finger of second gnathopod.
prp. 3.—Third peraeopod.
urp. 1, *2*, *3*, *T.*—First, second, and third uropods, and telson, with further enlargement of one apex of the telson.
The mouth organs and further enlargements of gnathopod and telson are magnified to a higher scale than the other details.



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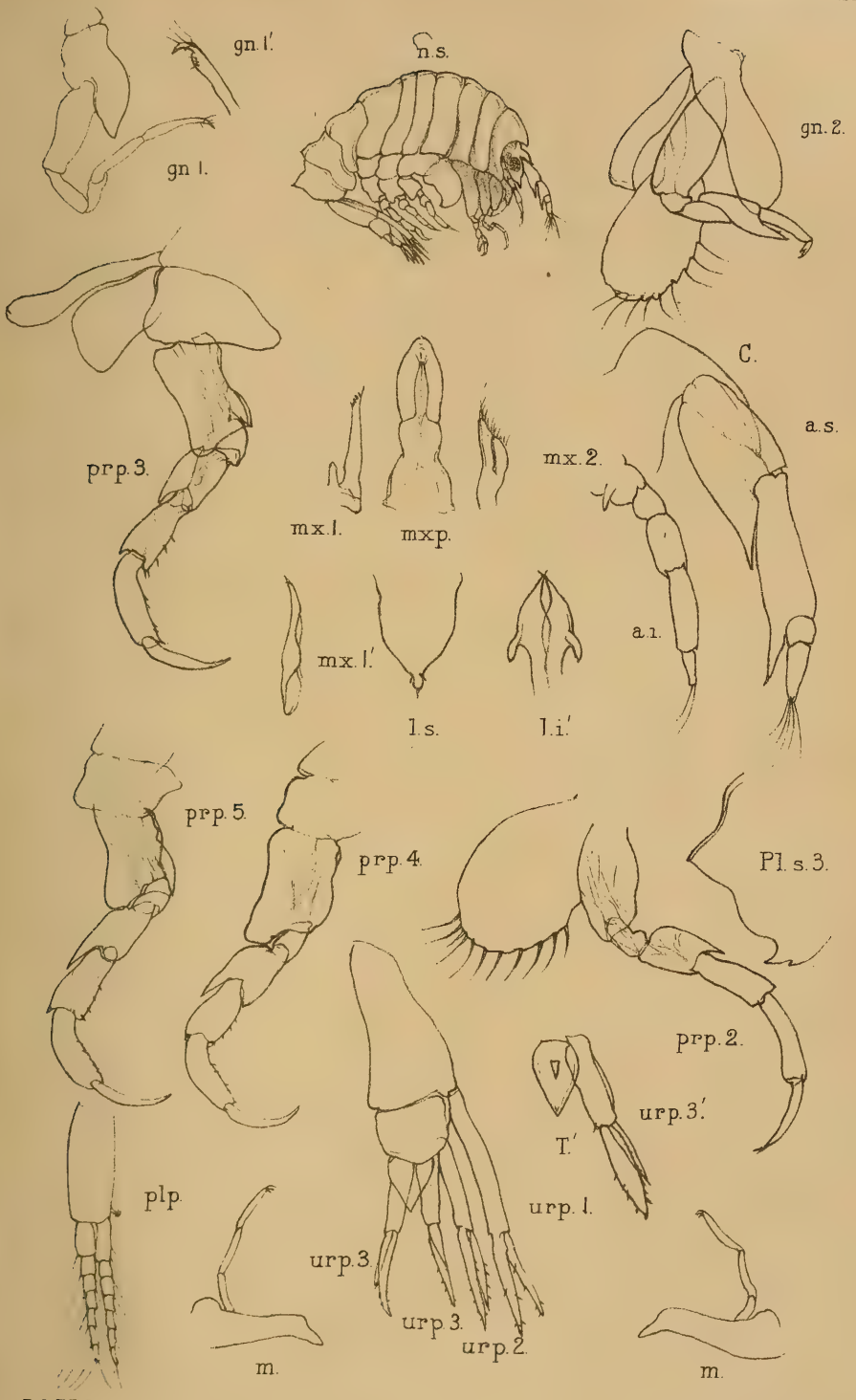
A. TRYPHOSA CAMELUS, *n.sp.*

B. WALDECKIA CHEVREUXI. *n.sp.*

EXPLANATION OF PLATE XLVIII.*

Ochlesis innocens, gen.nov. et sp.

n.s.—Line indicating natural size of specimen figured below.
a.s., *a.i.*—First and second antennæ.
l.s., *l.i.*—Upper and lower lips.
m.m., *mx.1*, *mx. 2*, *mxp.*—Mandibles, first and second maxillæ, and maxillipeds.
mx. 1'.—First maxilla.
gn. 1, *gn. 2*, *prp. 2*, *3*, *4*, *5.*—First and second gnathopods, second, third, fourth, and fifth peraeopods.
gn. 1'.—Finger and part of sixth joint of first gnathopod.
plp.—One of the pleopods.
urp. 1, *2*, *3*, *3.*—Pleon from the fourth segment to the end, with urp. 1 and 2 of the right side, and the pair of urp. 3.
T., *urp. 3.*—The telson and third uropod of the specimen figured at the top of the plate, of which also the lower lip, first maxilla, part of first gnathopod, third uropod and telson are represented. All the other details were drawn from a slightly smaller specimen. All the detail figures are drawn to the same scale.



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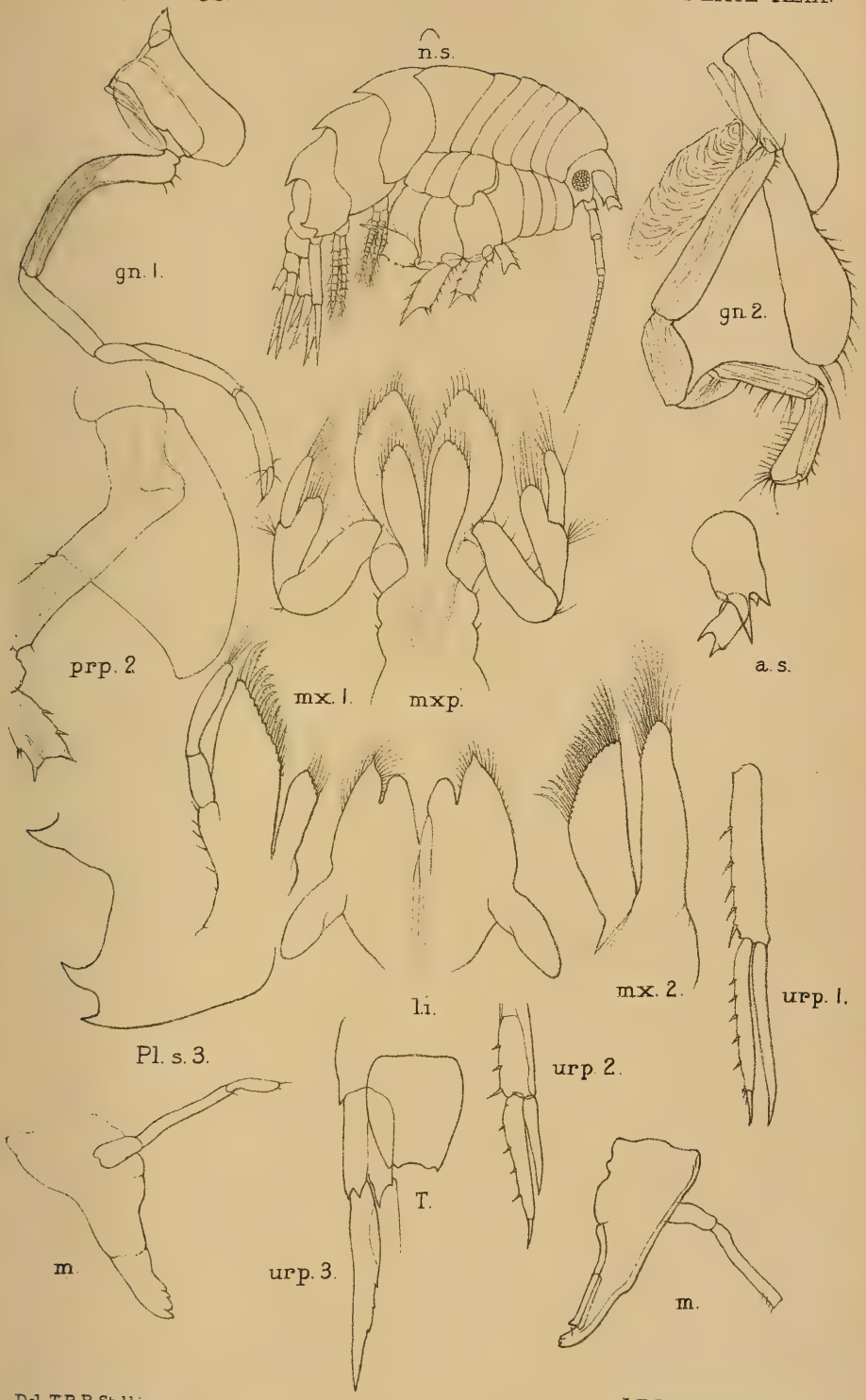
OCHLESIS INNOCENS, *n. sp.*

EXPLANATION OF PLATE XLIX.*

Iphimedia discreta, sp. nov.

n.s.—Line indicating natural size of the specimen figured below.
Pl.s. 3.—Posterior lateral margin of third pleon segment.
a.s.—First two joints of first antenna.
m.m.—Mandibles, third joint of palp on the right of the plate missing.
l.i., *mx. 1*, *mx. 2*, *mxp.*—Lower lip, first and second maxillæ, maxillipeds.
gn. 1, *gn. 2*, *prp. 2.*—First and second gnathopods, and part of second peraeopod.
urp. 1, *2*, *3*, *T.*—First, second, and third uropods, and telson. In connection with urp. 3, broken lines are given to indicate that one ramus is missing.

The mouth-organs are figured on a uniform scale, higher than that (which is also uniform) for the other details.



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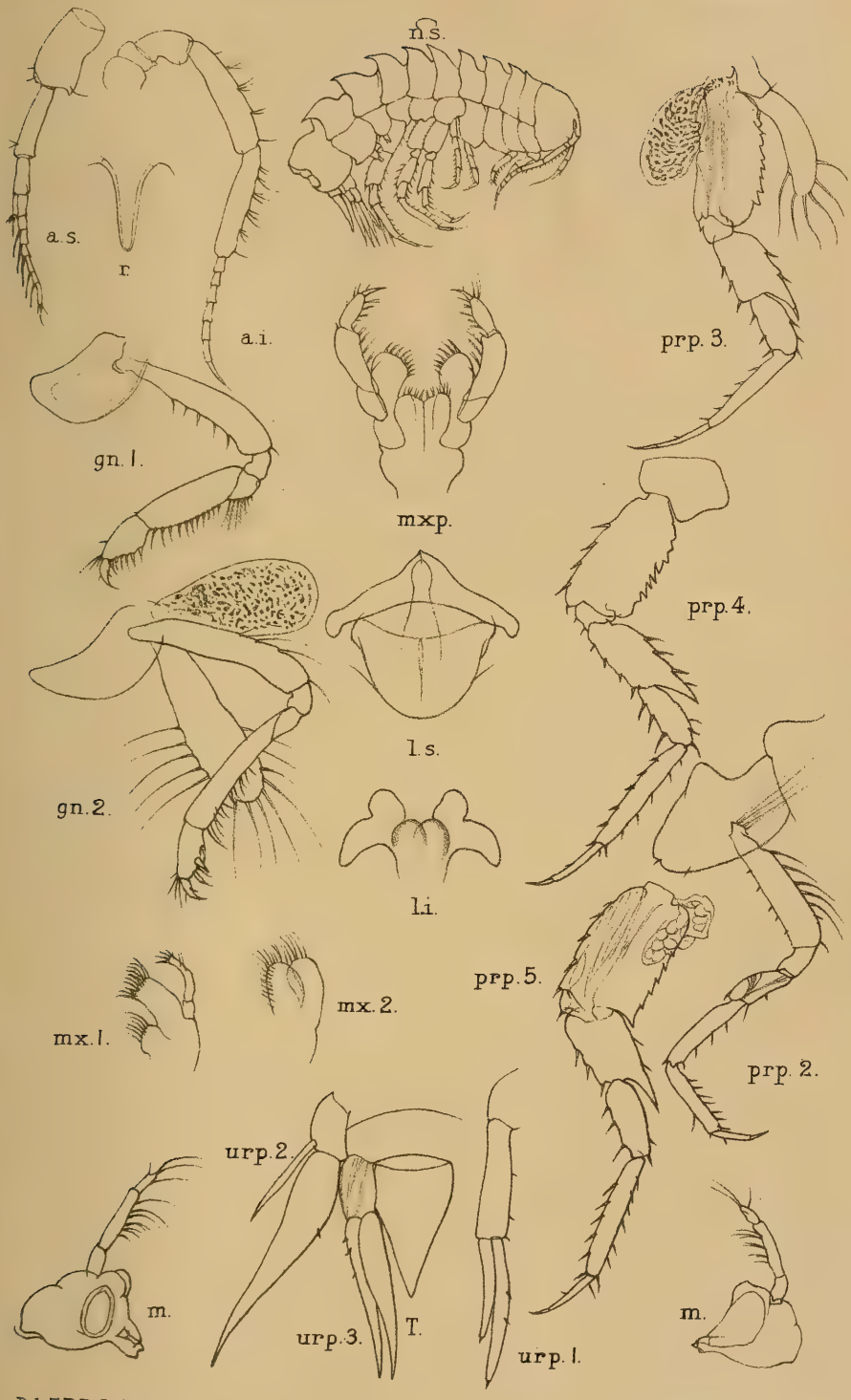
IPHIMEDIA DISCRETA, *n. sp.*

EXPLANATION OF PLATE L.*

Bruzelia australis, sp.nov.

n.s.—Line indicating natural size of the specimen figured below.
su. r.—Rostrum, flattened out.
a.s., *a.i.*—First and second antennæ.
l.s, *l.i.*—Upper and lower lips.
m.m., *mx. 1.*, *mx. 2*, *mxp.*—Mandibles, first and second maxillæ, maxillipeds.
gn. 1, *gn. 2*, *prp. 2*, *3*, *4*, *5*.—First and second gnathopods, second third, fourth, and fifth peraeopods.
urp. 1, *2*, *3*, *T.*—First, second, and third uropods, and the telson.
All the details are magnified to a uniform scale.



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BRUZELIA AUSTRALIS, *n. sp.*

EXPLANATION OF PLATE LI.*

Paraceradocus micramphopus, sp. nov

n.s.—Line indicating size of specimen figured below.

Pl.s. 1, 2, 3.—Postero-lateral margins of first three segments of the pleon.

l.s., *l.i.*—Upper and lower lips.

m.m., *mx. 1*, *mx. 2*, *mxp.*—The mandibles, first and second maxillæ, and one-half of the maxillipeds.

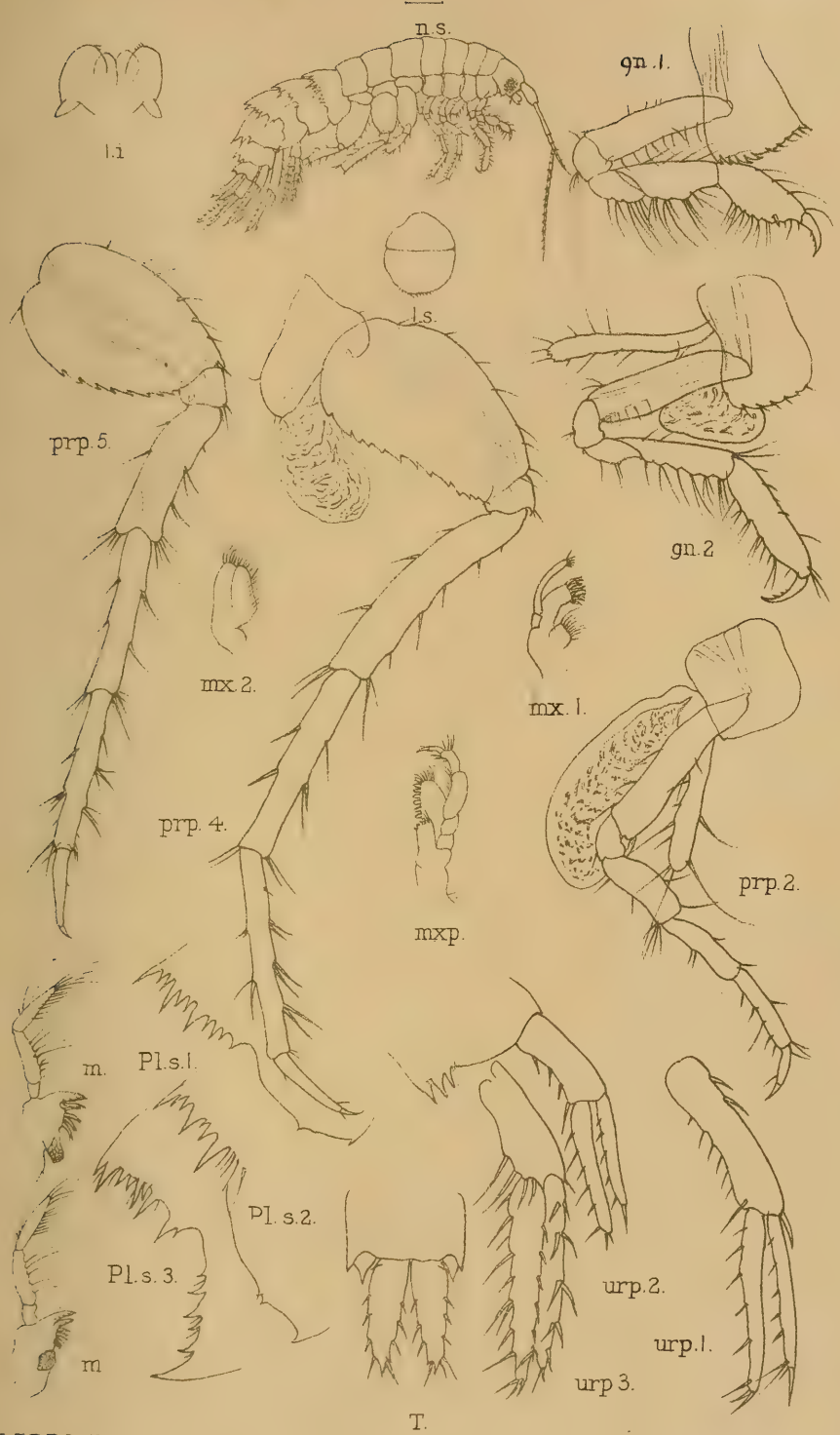
gn. 1, *gn. 2.*—The first and second gnathopods.

prp. 2, *4*, *5.*—The second, fourth, and fifth peraeopods.

urp. 1, *2*, *3.*—The first, second, and third uropods; the postero-lateral margin of the fifth pleon segment shown in connection with the second uropods.

T.—Dorsal view of the telson, in connexion with the sixth pleon segment.

All the details are drawn to a uniform scale, and are taken from a second specimen, not the one figured as (an imperfect) whole.



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PARACERADOCUS MICRAMPHOPUS. *n. sp.*

EXPLANATION OF PLATE LII.*

Paradexamine flindersi (Stebbing).

n.s.—Line indicating natural size of female specimen figured below.

a.s., *a.i.*—First and second antennæ.

l.s., *l.i.*—Upper and lower lips.

m.m., *mx. 1*, *mx. 2*, *mxp.*—Mandibles, first and second maxillæ, and maxillipeds. The maxillæ drawn from a different and rather smaller specimen.

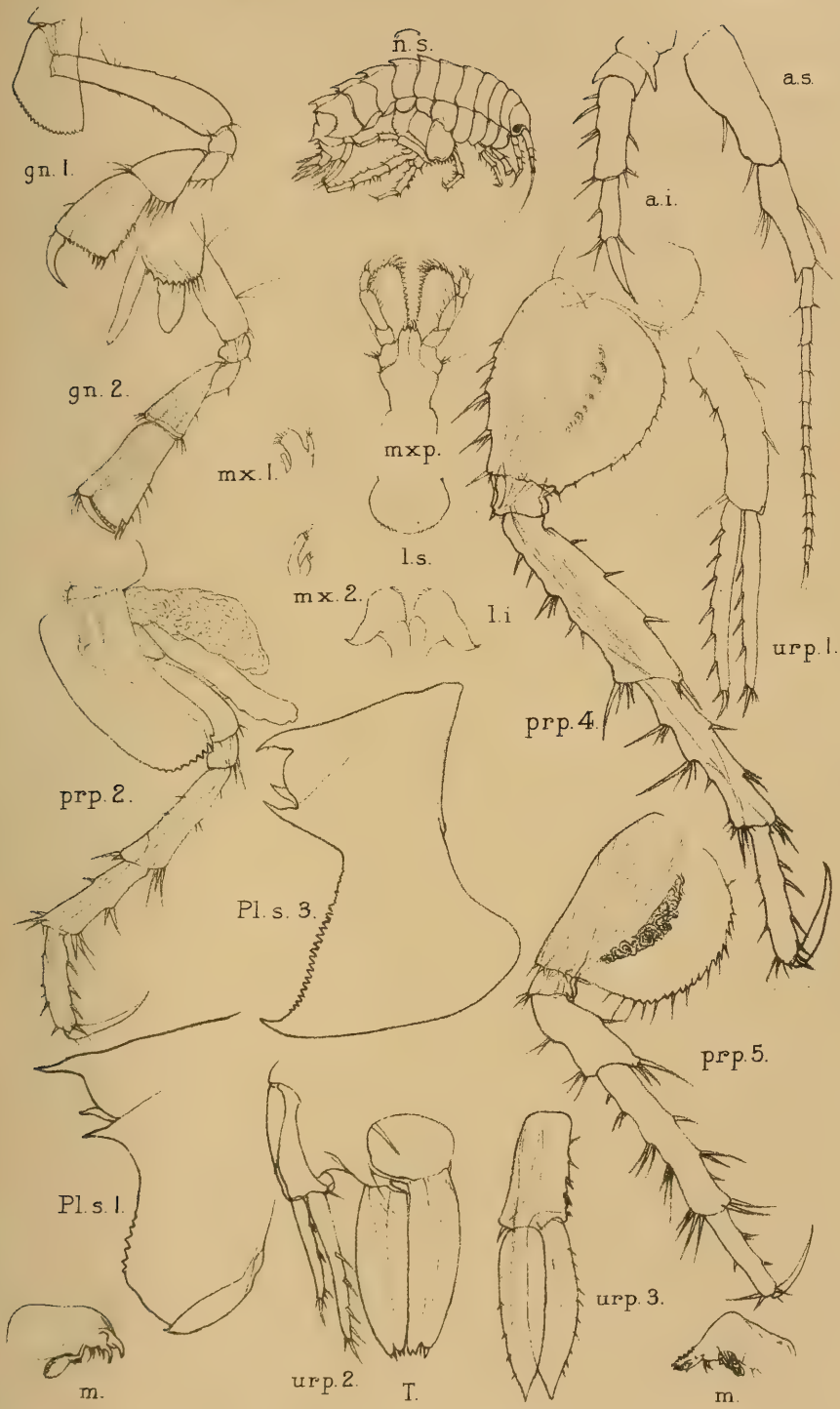
gn. 1, *gn. 2.*—First and second gnathopods, base of second incomplete.

prp. 2, *4*, *5.*—Second, fourth, and fifth peraeopods.

Pl.s. 1, *3.*—First and third pleon segments in profile.

urp. 1, *3.*—First and third uropods.

urp. 2, *T.*—Second uropod and telson in dorsal view, as attached to the compound (fifth and sixth) pleon segment, of which the left side is shown with its two medio-dorsal spines.



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PARADEXAMINE FLINDERSI *(Stebbing)*

EXPLANATION OF PLATE LIII.*

Paraoroides unistilus, gen. et sp.nov.

n.s.—Line indicating natural size of specimen figured below.

a.s.♂, *a.s.*—Upper antennæ of adult male, with higher magnifition of last joint of peduncle and first of flagellum, to show comparative size of accessory flagellum. The detail figures marked ♂ and the mouth-organs are from the specimen figured as a whole; the other details are from a specimen which is probably a female, with marginal plates undeveloped.

a.i.♂.—Distal part of second antenna of male, penultimate joint of peduncle in part.

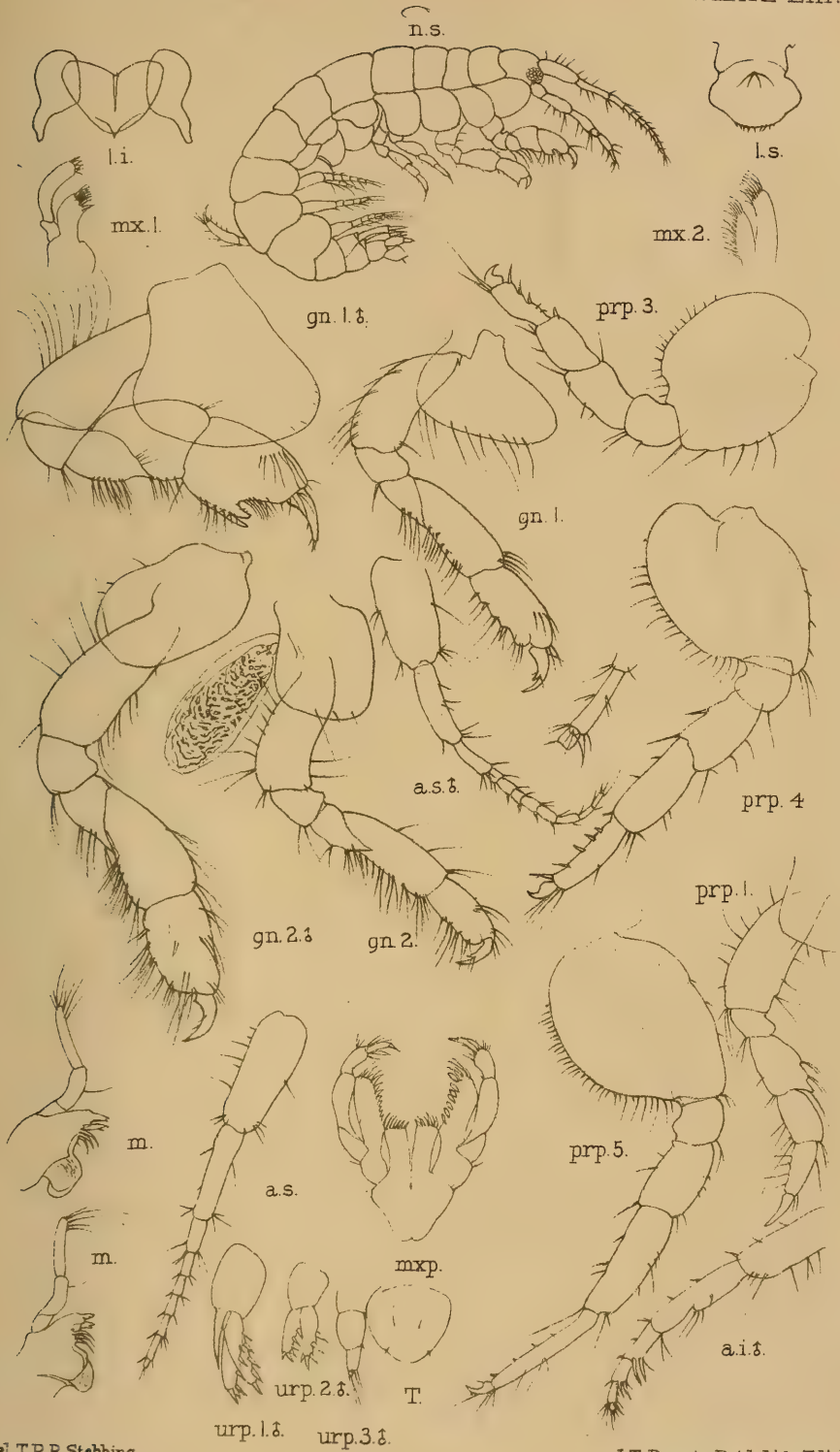
l.s., *l.i.*, *m.m*, *mx. 1.*, *mx. 2.*, *mxp.*—Upper and lower lips, mandibles, first and second maxillæ, and the maxillipeds.

gn. 1♂, *gn. 2*♂.—First and second gnathopods of adult male.

gn. 1, *gn. 2*, *prp. 1*, *3*, *4*, *5*.—First and second gnathopods, first, third, fourth and fifth peraeopods of (supposed) female.

urp. 1♂, *2*♂, *3*♂, *T*.—First, second, and third uropods, and telson of adult male.

The mouth-organs and portion of first antenna are magnified on a higher scale than the other details.



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PARAOROIDES UNISTILUS, *n.g. et sp.*

EXPLANATION OF PLATE LIV.*

Cheiriphotis australis, sp.nov.

n.s.♂.—Line indicating natural size of male specimen figured below.

a.s.♀, *a.i.*♀.—First and second antennæ of the female.

l.s.♀, *m* ♀, *mxp.*♀.—Upper lip, mandible, and maxillipeds of the female.

mx. 1♂, *mx. 2*♂.—First and second maxillæ of the male, with higher magnification of spines of the first maxilla.

gn. 1♂, *gn. 2*♂, *gn. 1*♀, *gn. 2*♀.—First and second gnathopods of the male and female.

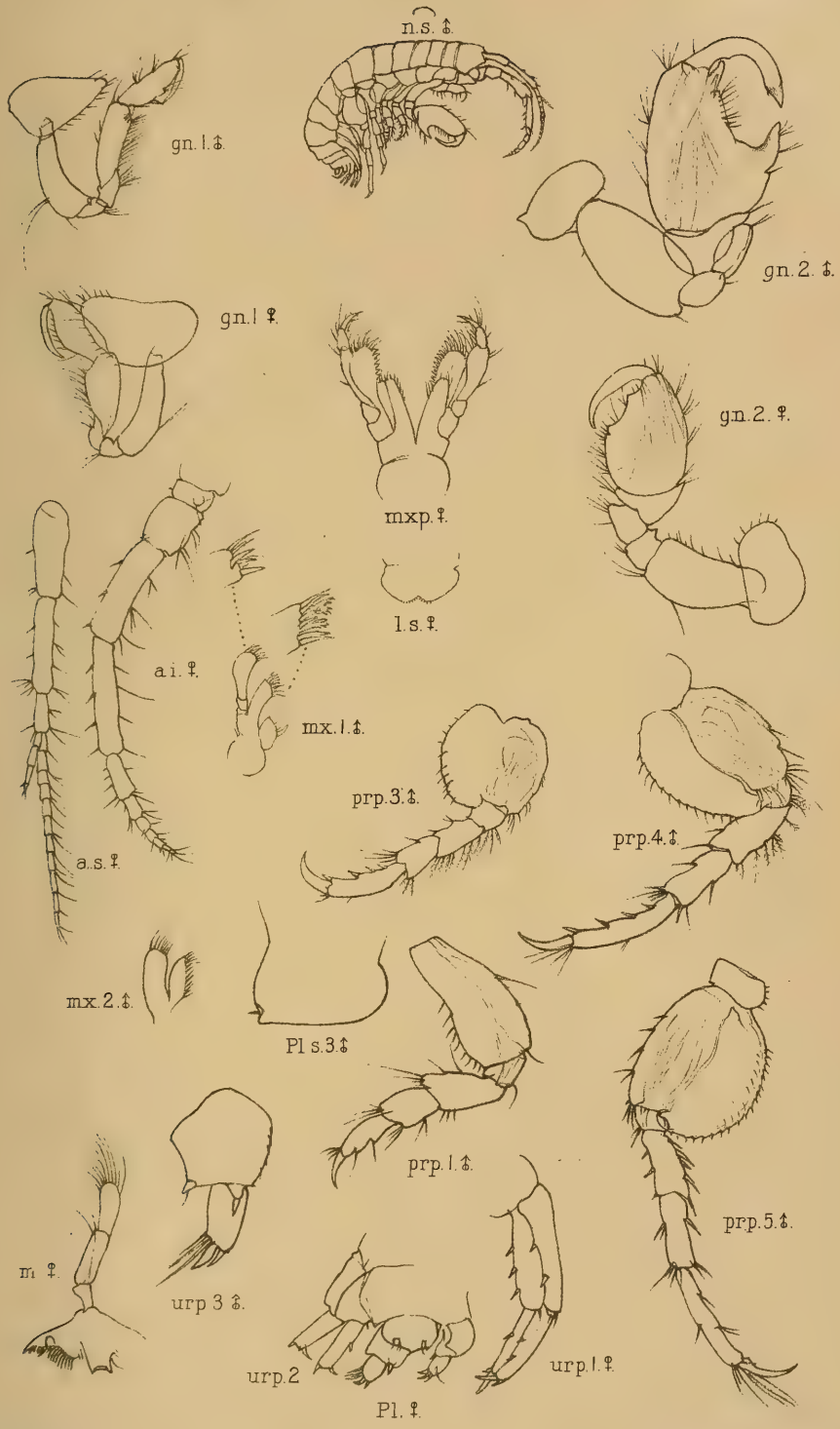
prp. 1, 3, 4, 5♂.—First, third, fourth, and fifth peraeopods of the male.

Pl.♀.—Terminal part of pleon of the female, showing in position the telson, one of the second uropods, and the third uropod slightly deflected by pressure.

urp. 1♀.—First uropod of female.

urp. 3♂.—Third uropod of male, more highly magnified than the other details, except the apical spines of mx. 1.

Pl.s. 3♂.—Part of third pleon segment of male. This, with the telson and uropod of the female, is magnified to the same scale as the mouth-organs, which are more enlarged than the antennæ and limbs.



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CHEIRIPHOTIS AUSTRALIÆ. *n.sp.*

EXPLANATION OF PLATE LV.A.*

Cerapus abditus, Templeton.

n.s.—Lines indicating length of the tubes shown in the adjoining figure.

a.s., *a.i.*—First and second antennæ, with last two joints of the first antennæ more highly magnified.

gn.1, *gn.2*.—First and second gnathopods.

Pl. D.—Dorsal view of pleon from the fourth segment to the end.

Pl. V.—Ventral view of the same pleon, much more highly magnified. In this view all three uropods are visible; in the dorsal view the second uropods can scarcely be seen.

All the detail figures are from a male specimen. The tube contained a large female specimen.

EXPLANATION OF PLATE LV.B.*

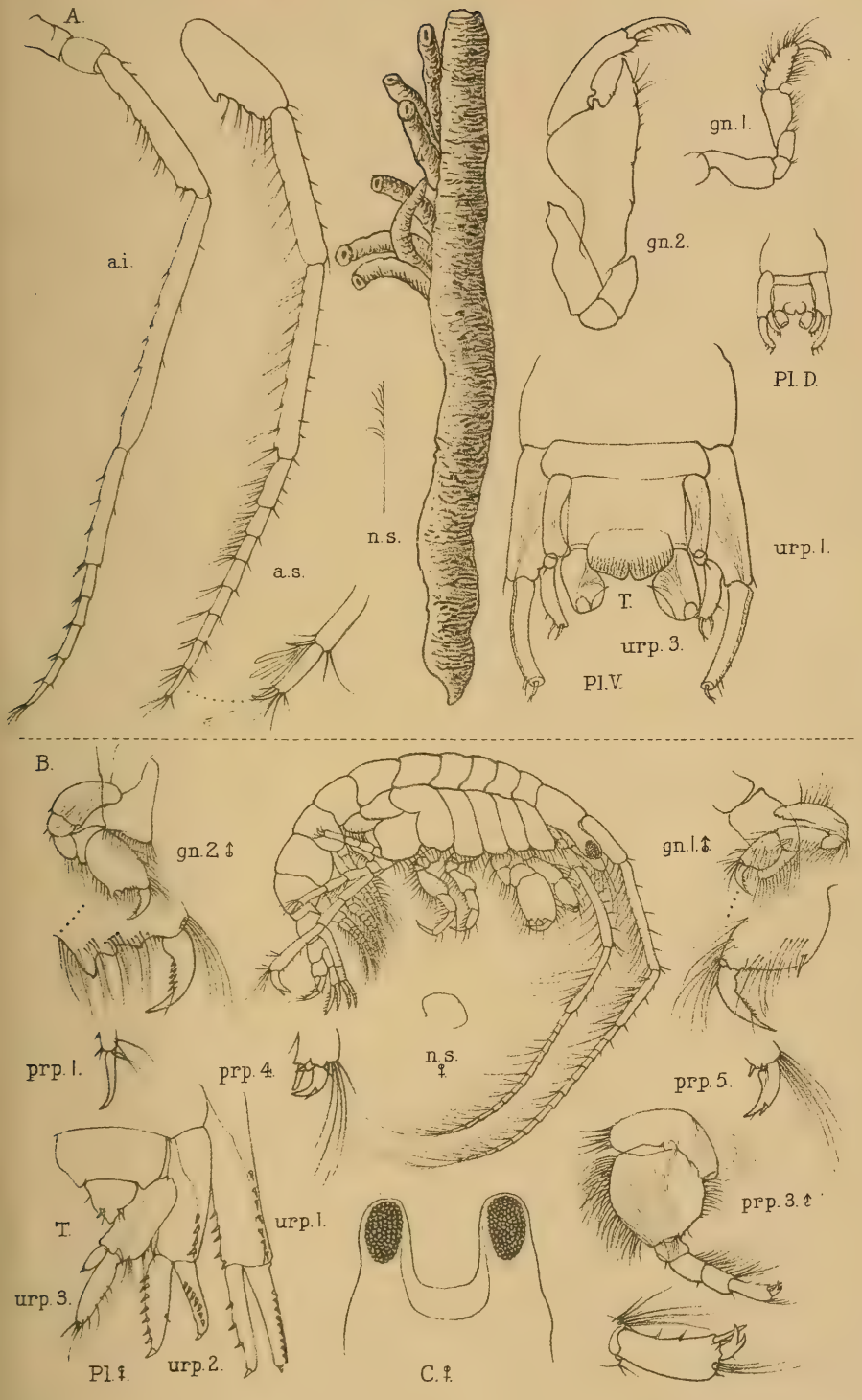
Photis dolichommata, sp.nov.

n.s.—Line indicating natural size of specimen figured above.

C.♀.—Dorsal view of eye-lobes, under slight compression, of a female specimen.

Pl.♀, *urp. 1, 2, 3, t.*—Dorsal view of sixth pleon segment, telson, and uropods of the last-mentioned specimen, also under slight compression.

gn. 1♂, *gn. 2*♂, *prp. 1, 3, 4, 5.*—First and second gnathopods and third peraeopods of a male specimen, with higher magnification of the distal extremities of these limbs, and the ends of the first, fourth, and fifth peraeopods, all these extremities being magnified to the same scale as the above-mentioned details of the female specimen.



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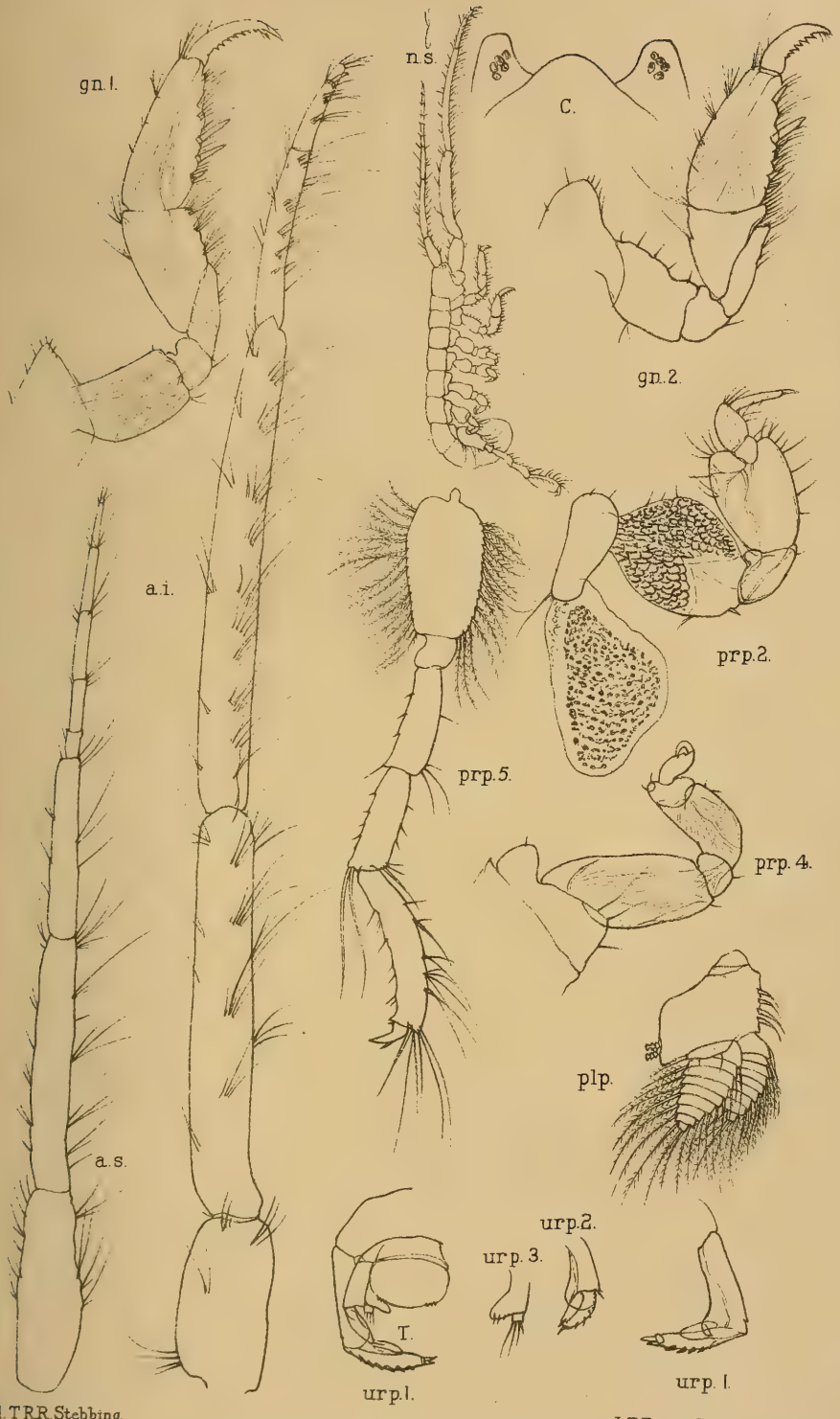
A. CERAPUS ABDITUS. Templeton. B. PHOTIS DOLICHOMMATA. *n.sp.*

EXPLANATION OF PLATE LVI.*

Siphonœcetes australis, sp.nov.

n.s.—Line indicating natural size of specimen figured below.
C.—Front of head, from another specimen, female.
a.s., *a.i.*—First antenna, and all but first two joints of second antenna.
gn.1, *gn 2.*—First and second gnathopods.
prp. 2, *4*, *5.*—First, fourth, and fifth peraeopods.
urp. 1, *2*, *3.*—First, second and third uropods.
T., *urp. 1.*—Dorsal view of part of pleon, showing the three uropods and telson in position, the uropods, however, not so closely folded upon one another as when first extracted from the shell.

All the detail figures are drawn to the same scale of magnification, and all are taken from the specimen figured in full, except the dorsal view of the front of the head.



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SIPHONŒCETES AUSTRALIS. *n. sp.*

EXPLANATION OF PLATE LVII.B.*

Gitanogeiton sarsi, gen. et sp. nov.

n.s.—Line indicating length of specimen from which the illustrations were drawn.

a.s., *a.i.*—First antenna and peduncle of second.

l.s., *l.i.*, *m.m.*—Upper and lower lips and mandibles, with higher magnification of parts of the cutting plates and spine-row on left mandible.

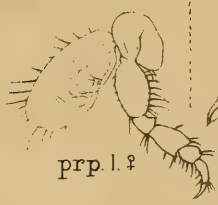
mx.1, *mx.2*, *mxp.*—First maxillæ, one of the second maxillæ, and the maxillipeds.

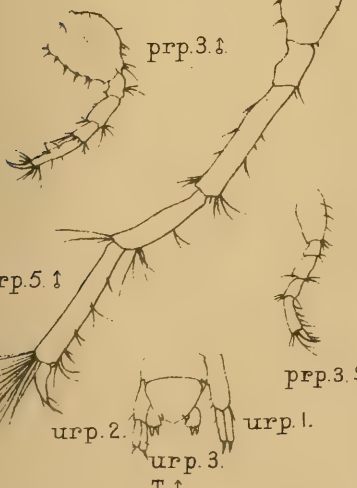
n.1, *gn.2*.—First and second gnathopods.

prp.1, *2*, *3*.—Parts of first, second, and third peraeopods.

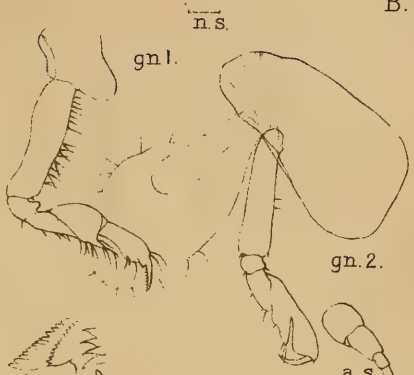
The mouth-organs are magnified on a higher scale than the other details.

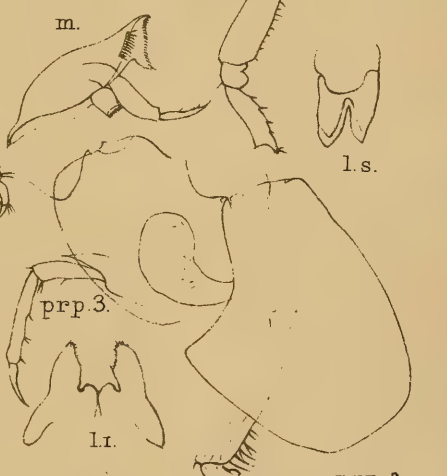
A.

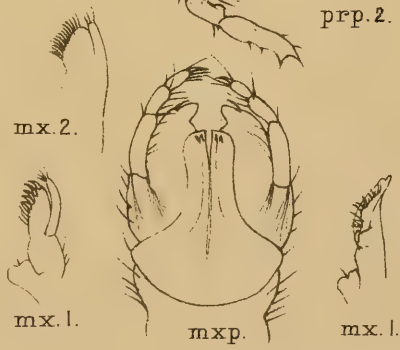




B.







Del. T.R.R. Stebbing. J.T. Rennie Reid Lith. Edin.r

A. DRYOPOIDES WESTWOODI, Stebbing.

B. GITANOGEITON SARSI, n.g. et sp.

EXPLANATION OF PLATE LVIII.*

Podocerus hystrix, sp.nov.

n.s.♂.—Line indicating natural size of male specimen figured above.

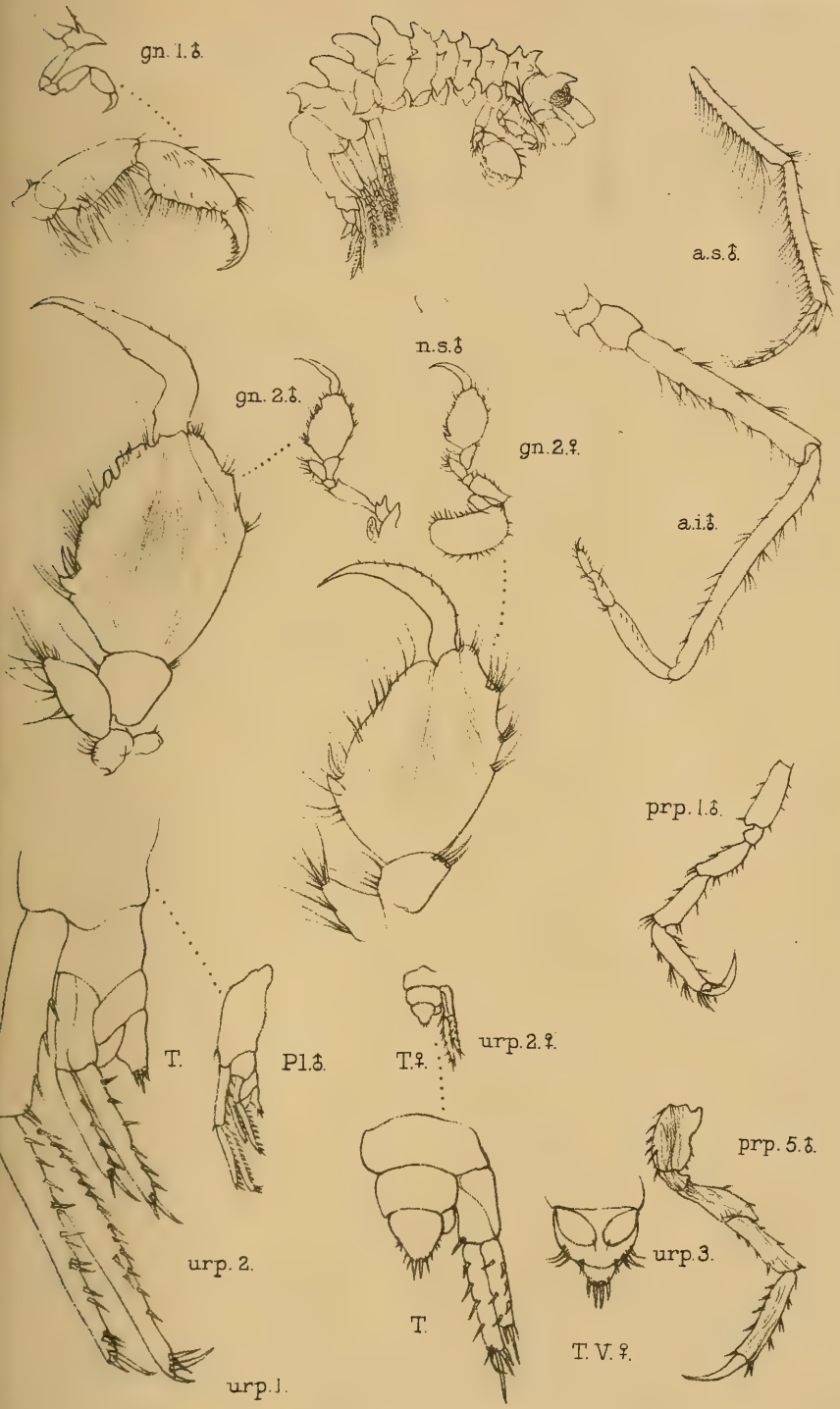
a.s.♀, *a.i.*♂.—First antenna, without first joint, and second antenna of a male.

gn.1♂, *gn.2*♂, *gn.2*♀.—First and second gnathopods of a male and second gnathopod of a female, with higher magnification of distal part of each limb.

prp.1, *prp.5*.—First and fifth peraeopods of a male.

T.♀, *urp. 2*♀, *T. V.*♀, *urp.3*.—Dorsal view of second and third uropods and telson of a female specimen, magnified to the same lower and higher scales as the gnathopods; and ventral view of third uropods and telson from the same specimen still more highly magnified.

Pl.♂, *urp.1*, *urp.2*, *T.*—Side view of male pleon from the fourth segment to the end, with the three uropods and telson in position; the same more highly magnified, with omission of most of the long fourth segment.



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J. T. Rennie Reid, Lith Edin.r

PODOCERUS HYSTRIX, *n. sp.*

EXPLANATION OF PLATE LIX A.*

Icilius danæ, Stebbing.

Per.s.7, *Pl.s.1*, *Pl.s.2*.—Parts of seventh peraeon segment and first two pleon segments, flattened out.

prp.5.—Fifth peraeopod to end of fourth joint.

plp.1.—First pleopod.

urp.1, *2*, *3*, *T*.—First and second uropods, and dorsal view of sixth pleon segment carrying the third pair of uropods, without inner branch, and the telson, of which the apex is more highly magnified.

EXPLANATION OF PLATE LIX.B.*

Icilius punctatus, Haswell.

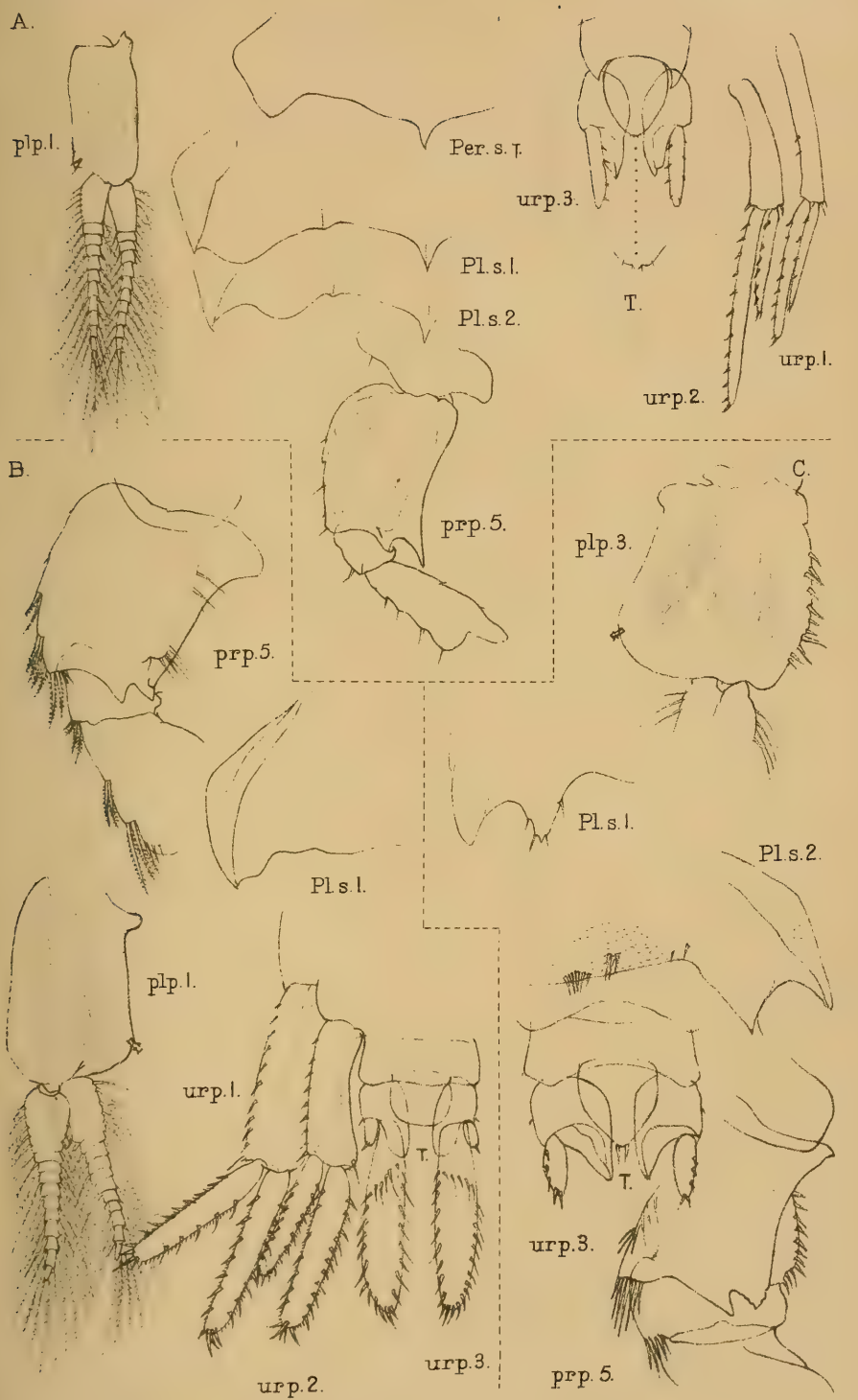
Pl s.1.—Part of first pleon segment flattened out.
prp.5.—Fifth peraeopod to midway of fourth joint.
plp.1.—First pleopod.
urp.1, 2, 3, T.—Dorsal view of sixth pleon segment carrying the third pair of uropods and the telson, with the first and second uropods in position, but a little flattened out.

EXPLANATION OF PLATE LIX.c.*

Icilius australis, Haswell.

Pl.s.1, *Pl.s.2*.—Parts of first two pleon segments flattened out.
prp.5.—Fifth peraeopod partially shown as far as base of fourth joint.
plp.3.—Peduncle and base of rami of third pleopod.
urp.3, *T*.—Sixth segment of pleon carry the third uropods, without inner branch, and the telson.

In plate LIX.A, B, and C, all the figures are to a uniform scale of magnification, except the tip of telson in A.



Del. T.R.R. Stebbing. J.T. Rennie Reid, Lith. Edinr.

A. ICILIUS DANÆ. Stebbing
B. I. PUNCTATUS, Haswell C. I. AUSTRALIS, Haswell.

EXPLANATION OF PLATE LX.*

Dodecas decacentrum, sp.nov.

n.s.♂.—Lines indicating natural size of male specimen figured below, without its fifth peraeopod.

a.s.♀.—First antenna of a female specimen.

a.i.♂.—Second antenna of a male specimen.

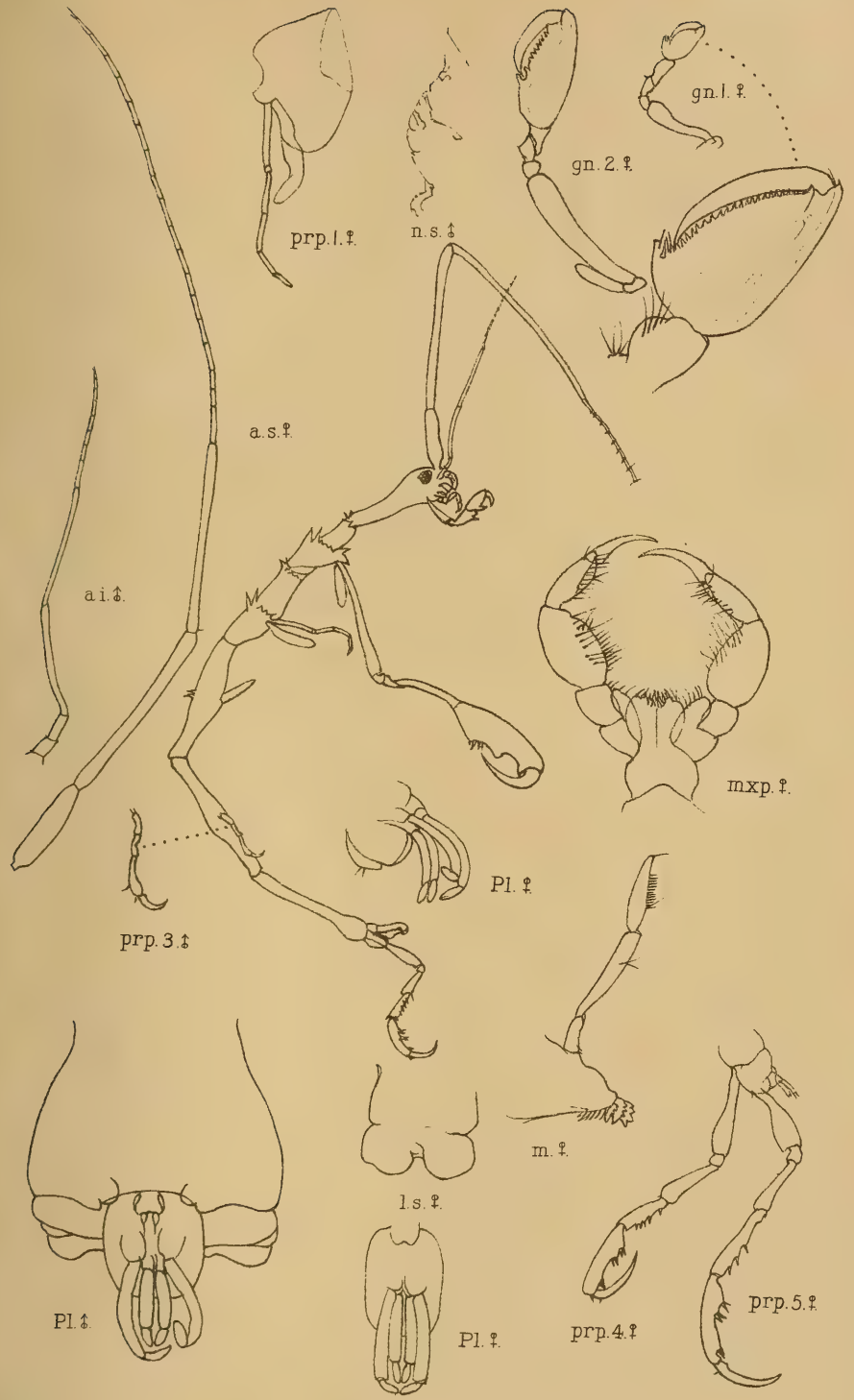
l.s.♀, *m.*♀, *mxp.*♀.—Upper lip, mandible, and maxillipeds of a female.

gn.1♀, *gn.2*♀.—First gnathopod and second gnathopod of a female, with further enlargement of distal portion of the first.

prp.1♀, *prp.3*♂, *prp.4*♀, *prp.5*♀.—The first peraeopod of a female with marsupial plate attached, third peraeopod of a male, fourth of a female and fifth of the same specimen, in attachment to the last peraeon segment, with the pleon in profile.

Pl.♀, *Pl.*♀, *Pl.*♂.—Pleon of each sex, the upper figure showing that of the female in lateral view, the lower showing it in ventral aspect, the figure on the left giving the same aspect of the male pleon, in attachment to the last peraeon segment.

These figures of the pleon, together with the mouth-organs and distal part of first gnathopod, are much more highly magnified than the other details.



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DODECAS DECACENTRUM. *n.sp.*

EXPLANATION OF PLATE LXI.

Fig. 1.—*Alcyonium* (*Erythropodium*) *reptans*, Kükenthal, growing on axis of *Primnoella australasiæ*, Gray. x 5.

Fig. 2.—Polyp of *Alcyonium etheridgei*, sp. nov. x 20.

Fig. 3.—Lobe of colony of the same with expanded polyps. x 2.

1

2

3

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EXPLANATION OF PLATE LXII.

Fig. 1.—*Acanthoisis flabellum*, Wright and Studer. x 2.

Fig. 2.—Detail of the same. x 20.

Fig. 3.—Very young colony of *Alcyonium etheridgei*, sp. nov. x 2.

Fig. 4.—*Dendronephthya waitei*, sp. nov. Complete colony. Nat. size.

1

3

4

2

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EXPLANATION OF PLATE LXIII.

Fig. 1.—Small portion of colony of *Mopsea flabellum*, sp. nov. Nat. size.

Fig. 2.—Axis of same. x 3.

Fig. 3.—Enlargement of polyps. x 12.

Fig. 4.—Spicules of *Mopsella textiformis*, Lamarck.

Fig. 5.—Axis of same, with a few patches of cœnenchyma. Nat. size.

1

2

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4

5

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EXPLANATION OF PLATE LXIV.

Fig. 1.—*Mopsea australis*, sp. nov. Nat. size.

Fig. 2.— ,, ,, . Enlarged tip of a dried branch. x 15.

Fig. 3.— ,, *elegans*, sp. nov. Small portion of a colony. Nat. size.

Fig. 4.— ,, ,, . Enlargement of stem and polyps. x 25.

1

2

3

4

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EXPLANATION OF PLATE LXV.

Fig. 1.—Polyp of *Caligorgia lævis*, sp. nov.

Fig. 2.— ,, *Dendronephthya waitei*, sp. nov.

Fig. 3.— ,, *Amphilaphis plumacea*, sp. nov.

Fig. 4.— ,, *Plumarella corruscans*, sp. nov.

Fig. 5.— ,, *Plumarella filicoides*, sp. nov.

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3

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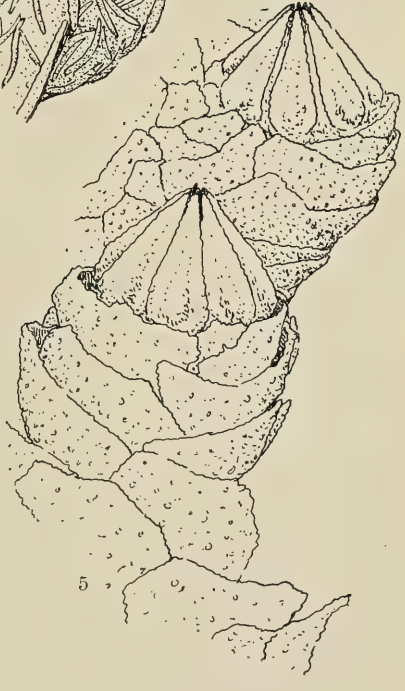

5

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EXPLANATION OF PLATE LXVI.

Fig. 1.—Polyp of *Plumarella lævis*, sp. nov.

Fig. 2.— ,, *Mopsea whiteleggei*, sp. nov.

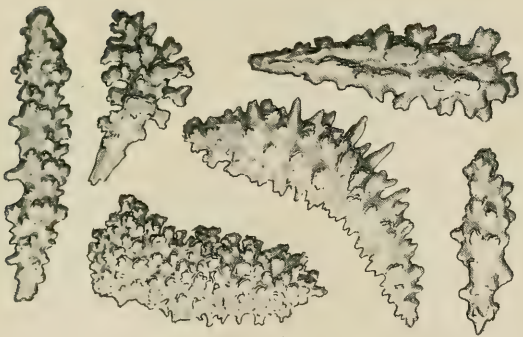
Fig. 3.—Spicules of the same.

Fig. 4.—Polyp of *Plumarella versluysi*, sp. nov.

Fig. 5.— ,, ,, *thetis*, sp. nov.

1

2



3

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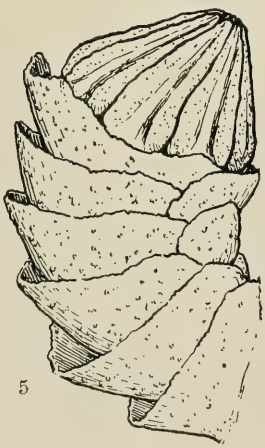

5

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EXPLANATION OF PLATE LXVII.

Fig. 1.—Spicules of *Mopsea dichotomà*, Linné.

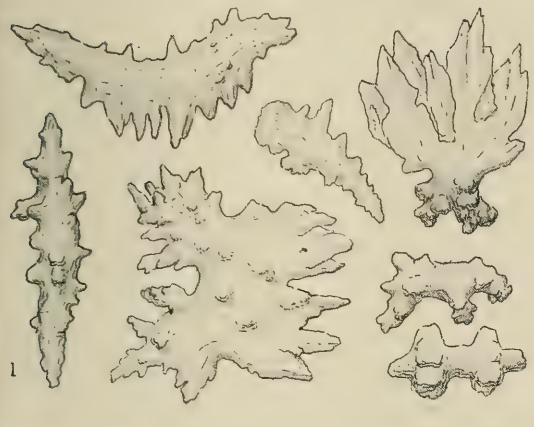
Fig. 2.— ,, *Telesto arborea*, Wright and Studer.

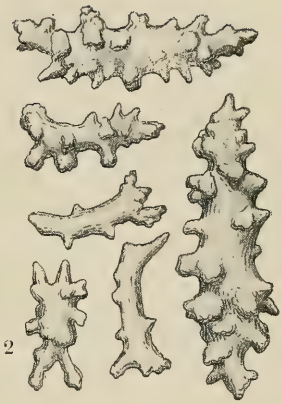
Fig. 3.— ,, *Dendronephthya waitei*, sp. nov., (a) cortex ; (b) base, (c) Stützbündel, (d) polyp.

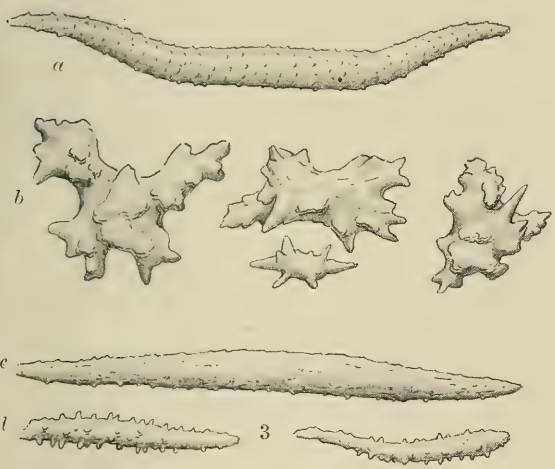
Fig. 4.— ,, *Alcyonium etheridgei*, sp. nov.

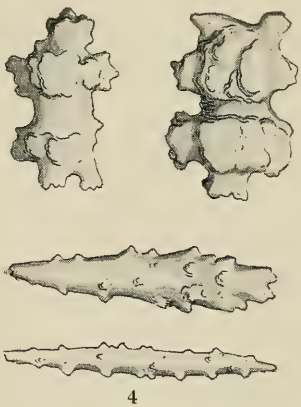
Fig. 5.— ,, *Mopsea australis*, sp. nov.

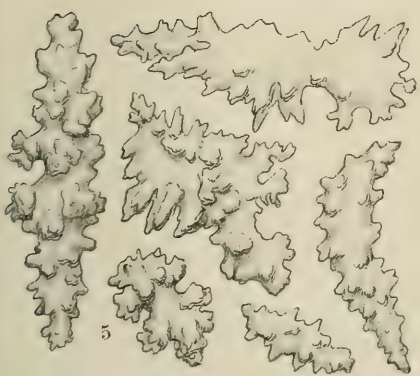
Fig. 6.— ,, ,, *flabellum*, sp. nov.

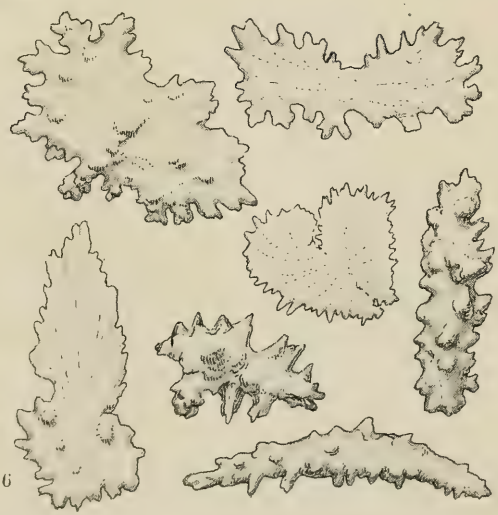












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EXPLANATION OF PLATE LXVIII.

Fig. 1.—Spicules of *Plumarella filicoides*, sp. nov.

Fig. 2.— ,, ,, *versluysi*, sp. nov.

Fig. 3.— ,, *Amphilaphis plumacea*, sp. nov.

Fig. 4.— ,, *Plumarella lævis*, sp. nov.

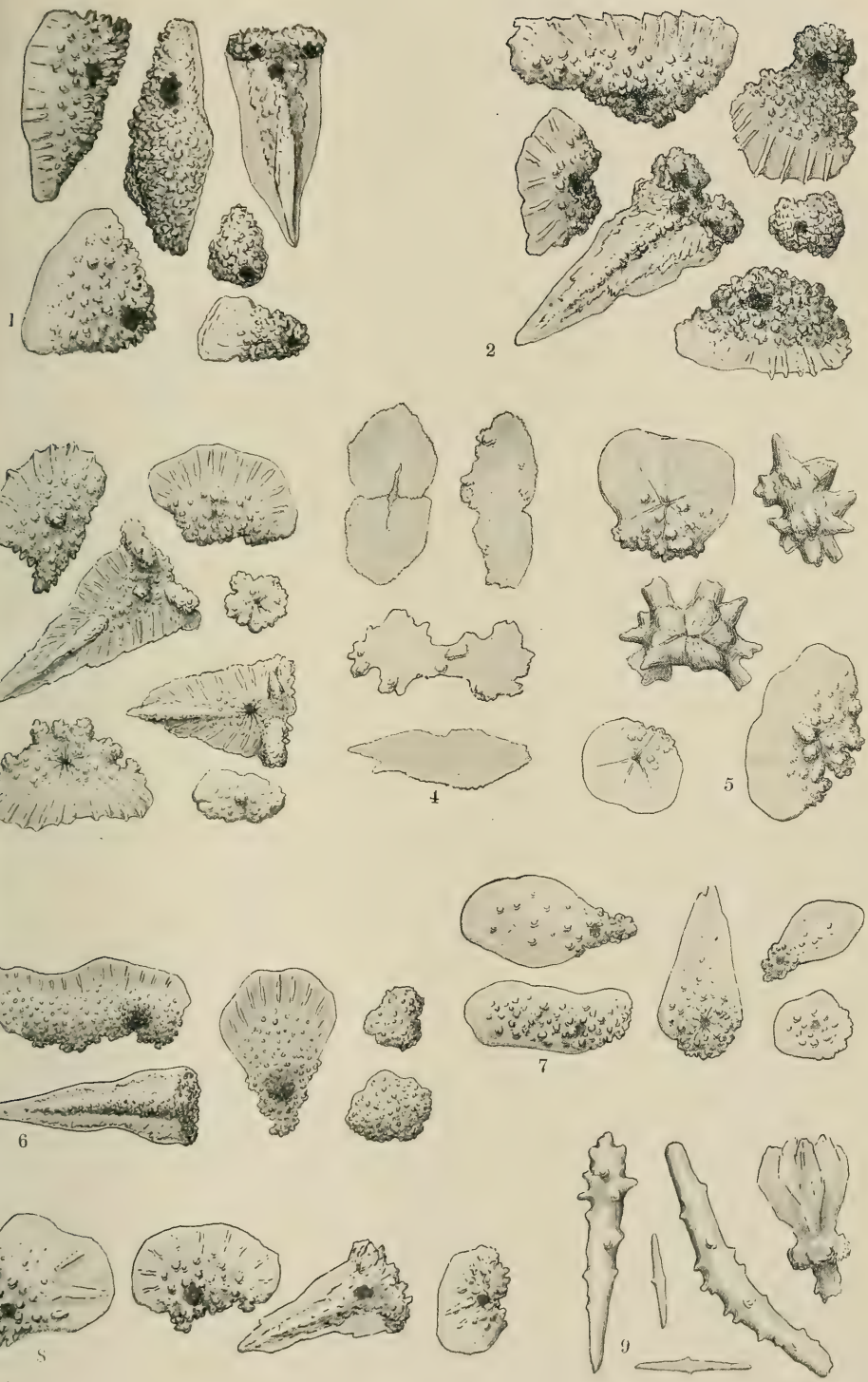
Fig. 5.— ,, *Mopsea elegans*, sp. nov.

Fig. 6.— ,, *Plumarella thetis*, sp. nov.

Fig. 7.— ,, *Caligorgia lævis*, sp. nov.

Fig. 8.— ,, *Plumarella corruscans*, sp. nov.

Fig. 9.— , *Mopsella clavigera*, Ridley.



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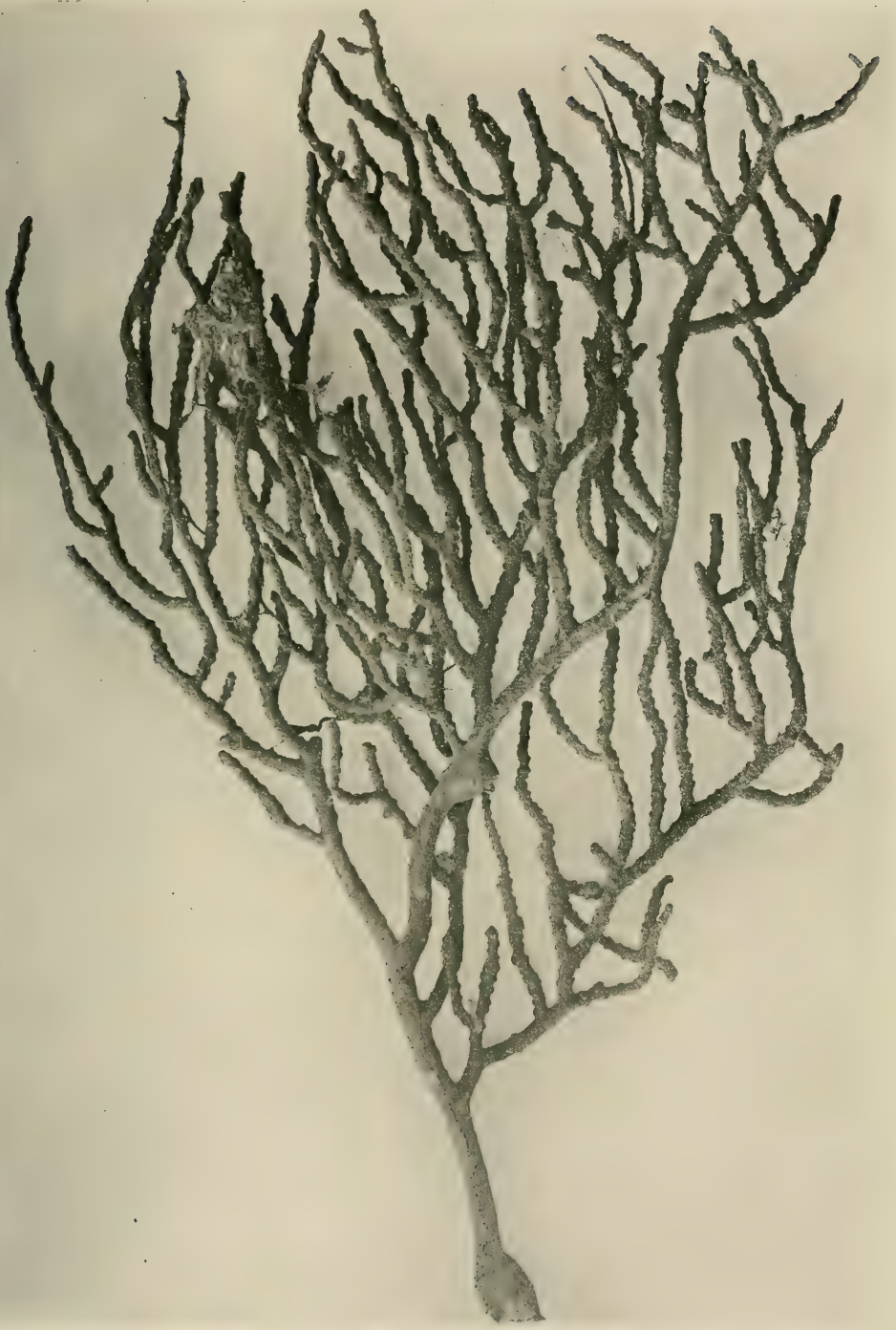
EXPLANATION OF PLATE LXIX.

Alcyonium etheridgei, sp. nov. Nat. size.

EXPLANATION OF PLATE LXX.

Parisis australis, Wright and Studer. $\frac{3}{4}$ nat. size.

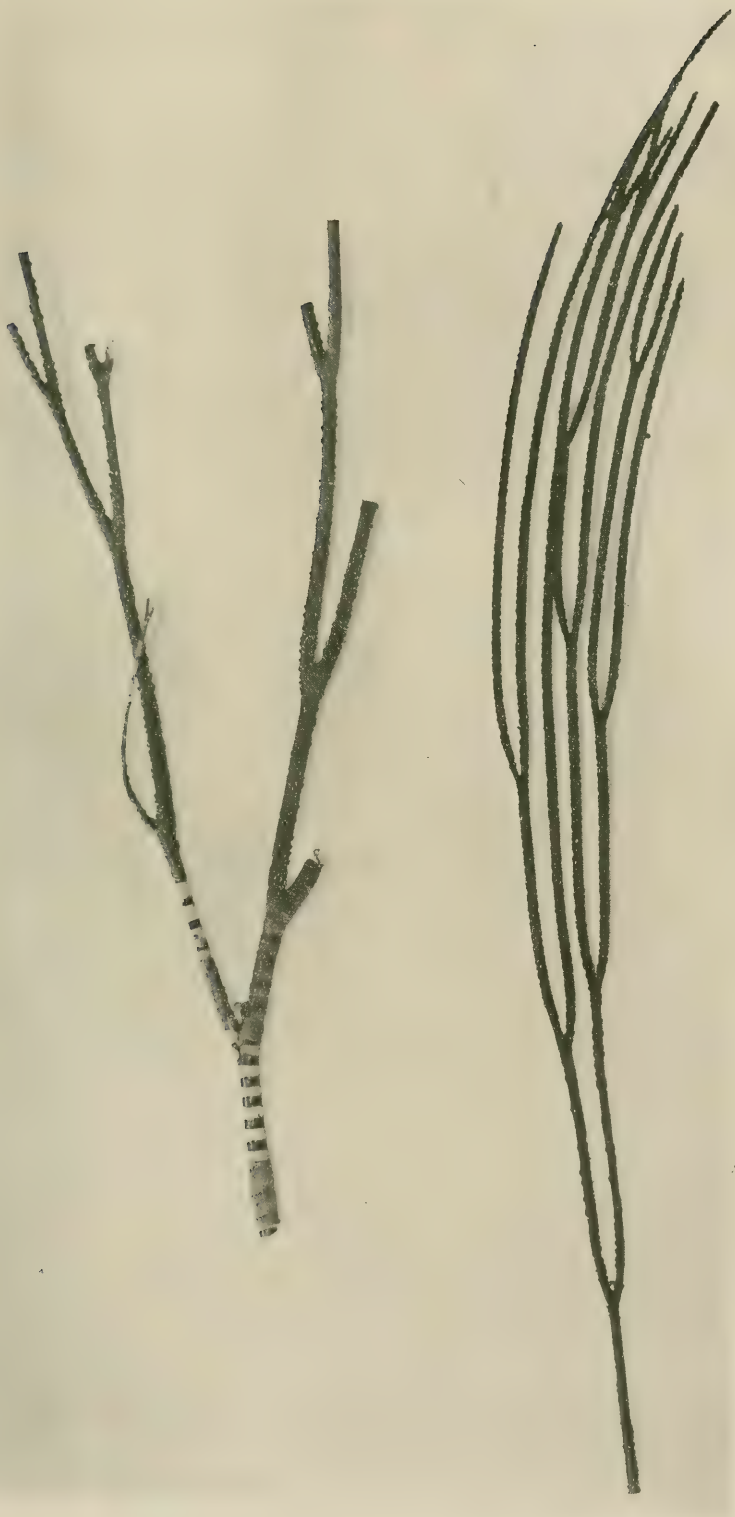


EXPLANATION OF PLATE LXXI.

Mopsella flabellum, sp. nov. Nat. size.

EXPLANATION OF PLATE LXXII

Mopsea elegans; sp. nov. Nat. size

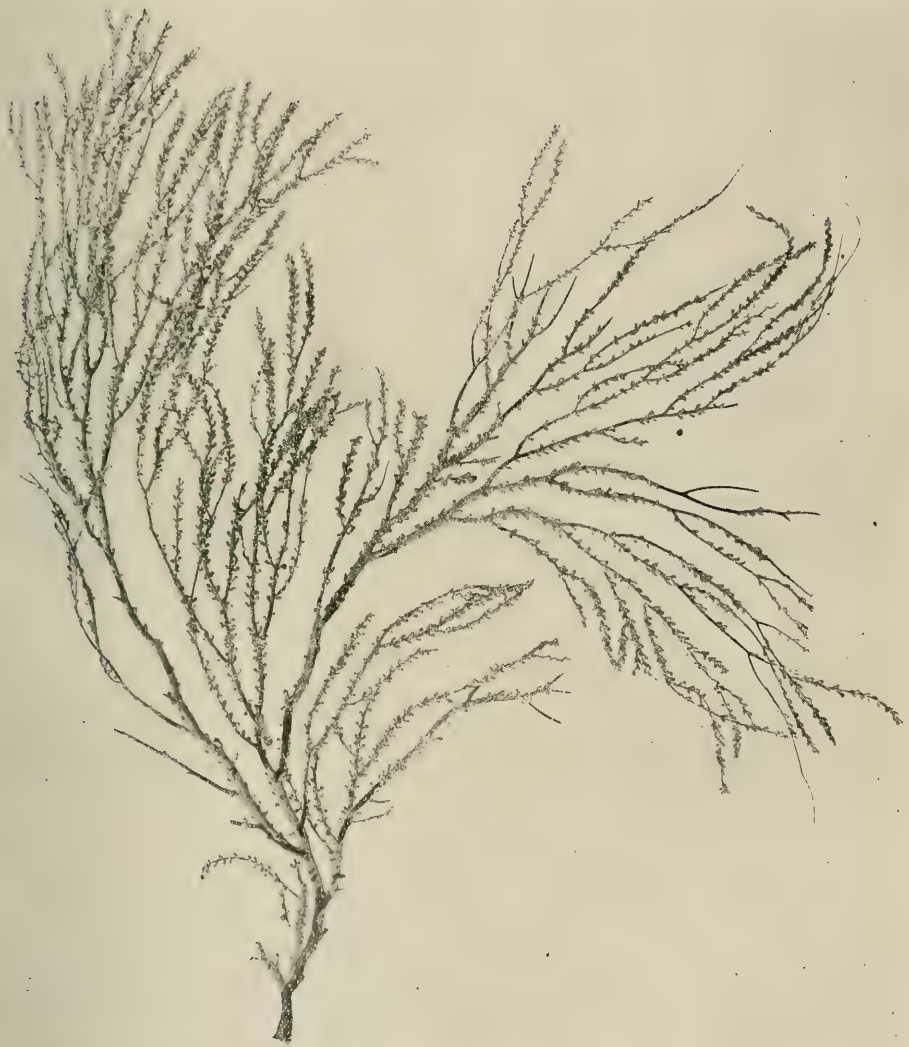


EXPLANATION OF PLATE LXXIII.

Mopsea whiteleggei, sp. nov. Nat. size

EXPLANATION OF PLATE LXXIV.

Amphilaphis plumacea, sp. nov. Nat. size.



EXPLANATION OF PLATE LXXV.

Plumarella lævis, sp. nov. Half nat. size.

EXPLANATION OF PLATE LXXVI.

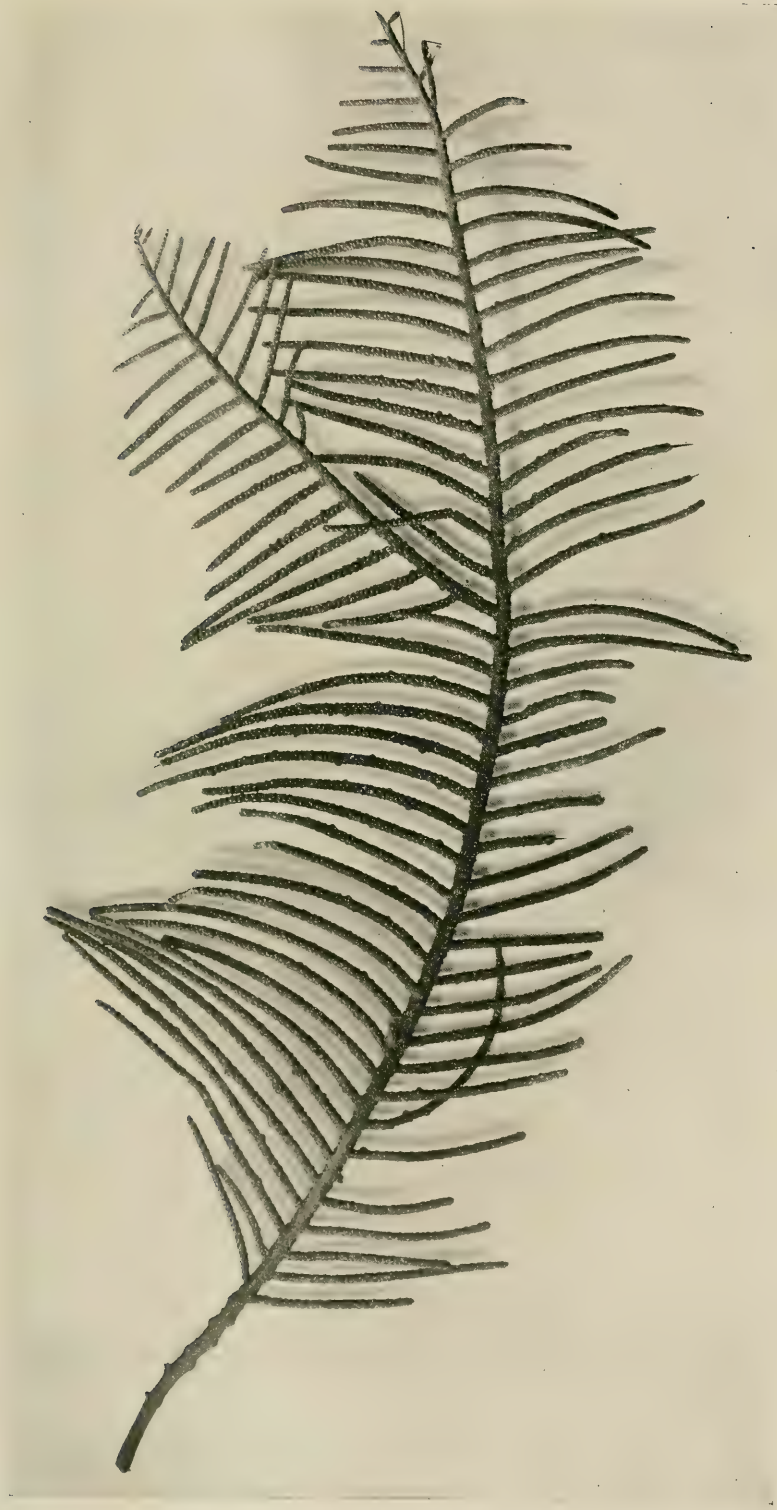
Plumarella thetis, sp. nov. Nat. size.

EXPLANATION OF PLATE LXXVII.

Plumarella corruscans, sp. nov. Half nat. size.

EXPLANATION OF PLATE LXXVIII.

Plumarella filicoides, sp. nov. Nat. size.



EXPLANATION OF PLATE LXXIX.

Plumarella versluysi, sp. nov. Nat. size.

EXPLANATION OF PLATE LXXX.

Caligorgia lævis, sp. nov. Nat. size.

EXPLANATION OF PLATE LXXXI.

Ctenocella pectinata, Pallas. Half nat. size.

EXPLANATION OF PLATE LXXXII.

Sarcophyllum australe, Kölliker. Nat. size.

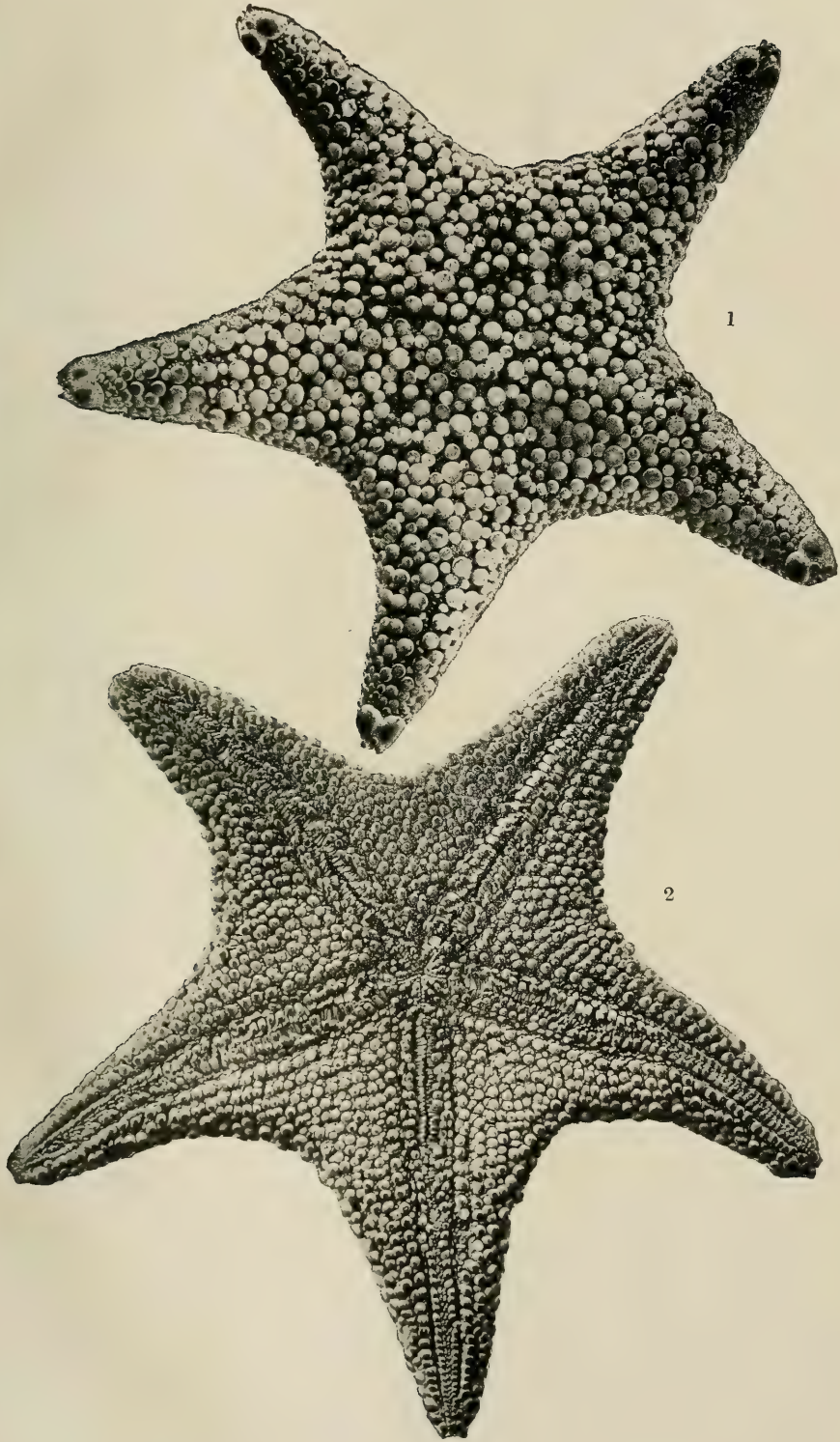
EXPLANATION OF PLATE LXXXIII.

ASTEROIDEA.

Asterodiscus truncatus, Coleman.

Fig. 1.—Dorsal surface of adult.

Fig. 2.—Ventral surface of the same.



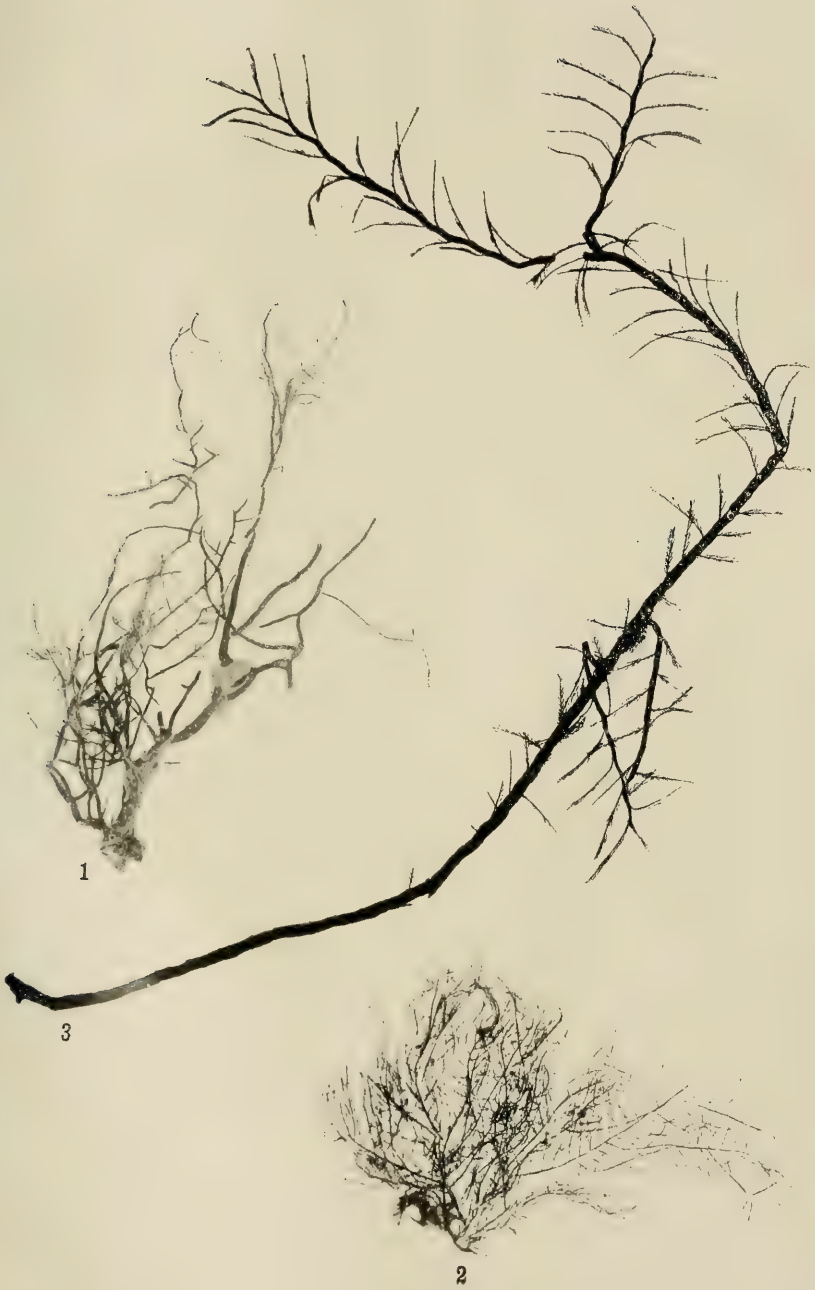
H. BARNES, JUNR., Photo.
Austr. Mus.

EXPLANATION OF PLATE LXXXIV.

Fig. 1.—*Cryptolaria arboriformis*, sp. nov., colony from Station 44, reduced to one-half nat. size.

Fig. 2.—*Cryptolaria conferta*, var. *australis*, var. nov., flabellate mass, formed of anastomosed colonies, from Station 42, reduced to one-half nat. size.

Fig. 3.—*Plumularia sulcata*, Lamarck, colony from Station 48, reduced to almost one-half nat. size.



J. RITCHIE, photo.

EXPLANATION OF PLATE LXXXV.

Fig. 1.—*Halicornaria thetidis*, sp. nov., colony from Station 48 reduced to $\frac{3}{4}$ nat. size.

Fig. 2.—*Halicornaria prolifera*, Bale, colony from New South Wales, reduced to $\frac{3}{4}$ nat. size.

Fig. 3.—*Halicornaria prolifera*, Bale, colony from New South Wales, reduced to $\frac{3}{4}$ nat. size.

Fig. 4.—*Thuiaria sinuosa*, Bale, colonies from Station 54. *St.*= hydroclades modified into stolons from which attendant colonies arise, reduced to almost one-half nat. size.

Fig. 5.—*Sertularella adpressa*, sp. nov., colonies from Station 54, reduced to almost one-half nat. size.

J. RITCHIE, photo.

EXPLANATION OF PLATE LXXXVI.

Fig. 1.—*Aglaophenia crucialis*, Lamouroux, colony from New South Wales, reduced to almost one-half nat. size.

Fig. 2.—*Halicornaria furcata*, Bale, branched colony from southern coast of New South Wales, reduced to almost one-half nat. size.

Fig. 3.—*Halicornaria furcata*, Bale, unbranched colony from Station 44, reduced to almost one-half nat. size.

J. RITCHIE, photo.

EXPLANATION OF PLATE LXXXVII.

Fig. 1.—*Cryytolaria conferta*, var. *australis*, var. nov.,[55] part of slightly fascicled branch with hydrothecæ, Station 42— × 40.

Fig. 2.—*Perisiphonia pectinata*, Allman, part of fascicled "pinna" of Allman's type specimen, from "Challenger" Station 169, off New Zealand. *Fasc.* = fascicle tube; *h* = hydrotheca with many reduplicated margins, the profile beneath the fascicle tubes faintly outlined; *s* = sarcotheca— × 50.

Fig. 3.—*Perisipnonia filicula*, Allman, part of fascicled "pinna" Station 57. *a* = outline of axial tube; *fasc.* = fascicle tube; *h* = hydrotheca; *s* = sarcotheca— × 50.

Fig. 4.—*Cryptolaria crassicaulis*, Allman,[55] part of branch of Allman's type specimen from "Challenger" Station 344, off Ascension Island, showing hydrotheca. *Att.*, level at which base of polyp was attached to hydrothecal wall— × 40.

Fig. 5.—*Cryptolaria crassicaulis*, var. *dimorpha*, var. nov.,[53] part of branch, Station 48, showing hydrotheca. *Att.*, level at which base of polyp is attached to hydrothecal wall— × 40.

Fig. 6.—*Cryptolaria crassicaulis*, var. *dimorpha*, var. nov., part of colony, Station 48, showing in the lower part, a stolon creeping upon a Polyzoon, and bearing two simple *Lafoëa*-like hydrothecæ, but afterwards developing into an erect typical *Cryptolaria* colony— × 10.

Fig. 7.—*Cryptolaria arboriformis*, sp. nov.,[55] part of fascicled branch with hydrothecæ, Station 44— × 40.

Fig. 8.—*Halecium sessile*, Norman, Station 54. Parts of branch showing variation in length of internodes— × 40.

Fig. 9.—*Halecium sessile*, Norman, Station 54. Parts of branch showing variation in length of internodes— × 40.

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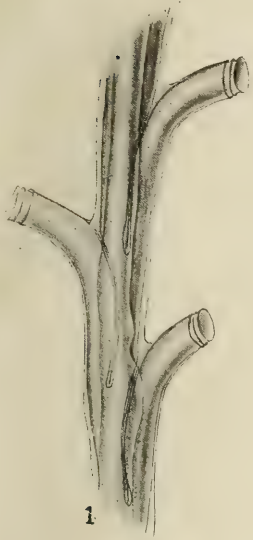
[55] For the sake of comparison, the figures of the various species of *Cryptolaria* (except Fig. 6) have been drawn with the same magnification.



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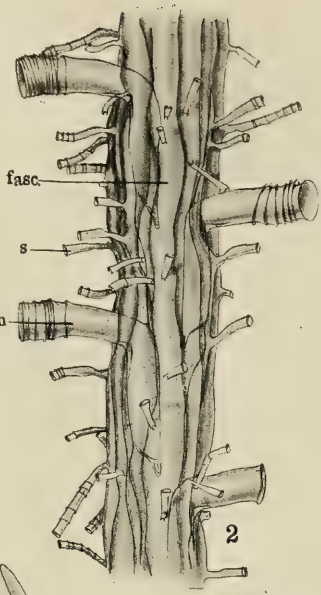

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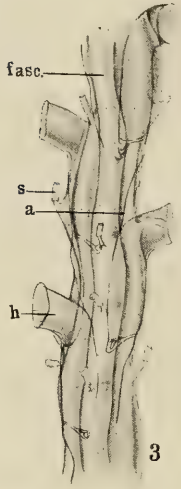

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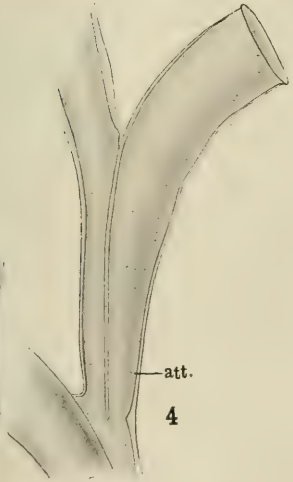

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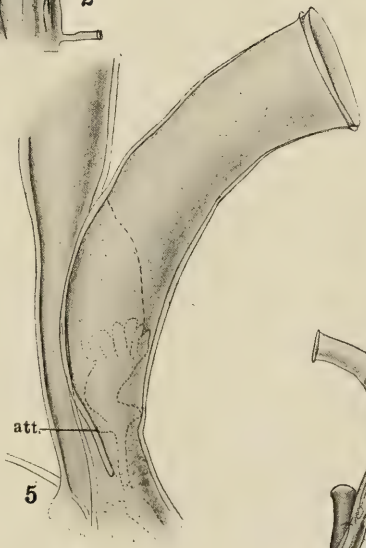

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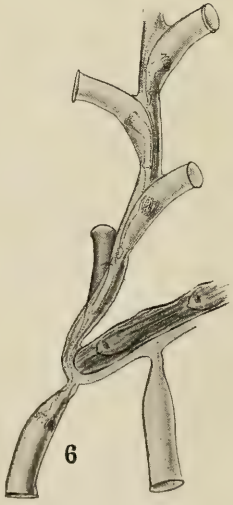

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EXPLANATION OF PLATE LXXXVIII.

Fig. 1.—*Sertularella adpressa*, sp. nov., part of branch, with gonangium seen from the anterior, Station 54— × 50.

Fig. 2.—*Sertularella adpressa*, sp. nov., part of branch, with gonangium, seen in lateral aspect, Station 54— × 50.

Fig. 3.—*Lictorella concinna*, sp. nov., colonies, Station 44— Nat. size.

Fig. 4.—*Lictorella concinna*, sp. nov., part of branch, with hydrothecæ, Station 44— × 55.

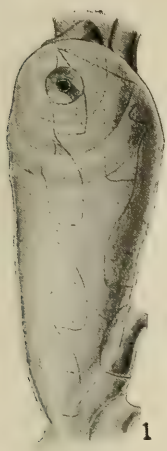
Fig. 5.—*Lafoëa tenellula*, Allman, sections of stolon, with hydrothecæ, Station 57— × 70.

Fig. 6.—*Sertularella turgida* (Trask) (?), part of stem with hydrothecæ, Station 57— × 24.

Fig. 7.—*Sertularella longitheca*, Bale, *typica*, part of stem with hydrothecæ, Station 57— × 24.

Fig. 8.—*Sertularella longitheca*, var. *robusta*, var. nov., part of stem with hydrotheca and base of branch, Station 48— × 24.

Fig. 9.—*Sertularella adpressa*, sp. nov., part of branch with hydrothecæ, Station 54— × 77.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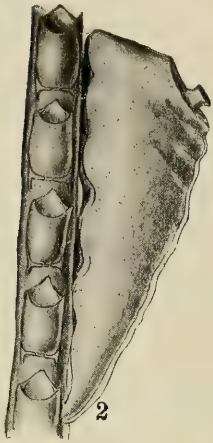
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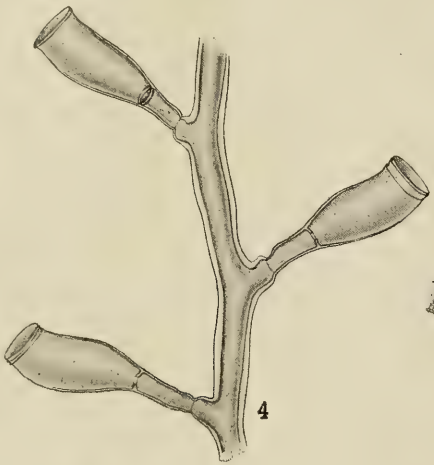
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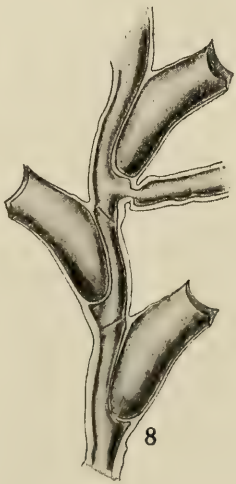
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EXPLANATION OF PLATE LXXXIX.

Fig. 1.—*Halicornopsis elegans* (Lamarck), hydrotheca. *f* = lateral flaps from internodes, uniting with side of hydrotheca; *s.ap* = median supra-calycine sarcopore behind hydrotheca; *i* = internal thickening of hydrothecal wall; *b.ap.* = antero-basal aperture of hydrotheca, through which polyp enters. Station 48— × 150.

Fig. 2.—*Cladocarpus bathyzonatus*, sp. nov., colony from Station 57—Nat. size.

Fig. 3.—*Halicornaria thetidis*, sp. nov., portion of hydroclade with hydrothecæ. *h* = hydrotheca; *ss.* = supracalycine sarcotheca; *m.s.* = median sarcotheca— × 70.

Fig. 4.—*Halicornaria thetidis*, sp. nov., part of stem with bases of two hydroclades, anterior aspect. *h* = hydroclade; *d.c.s.* = distal anterior cauline sarcotheca; *p.c.s.* = proximal anterior cauline sarcotheca; *p.s.* = posterior cauline sarcotheca— × 40.

Fig. 5.—*Plumularia sulcata*, Lamarck, lower part of hydroclade with hydrotheca, anterior aspect. *i.s.* = internodal sarcotheca; *l.s.s.* = lateral supracalcyne sarcotheca; *m.s s.* = median supracalycine sarcotheca; *h* = hydrotheca; *m s.* = median sarcotheca. Station 48— × 70.

Fig. 6.— *Cladocarpus bathyzonatus*, sp. nov., part of hydroclade with hydrothecæ, anterior aspect. *s.s.* = supracalycine sarcotheca; *h* = hydrotheca; *m.s.* = median sarcotheca; *n* = node—the horizontal lines are chitinous thickenings in the internode seen through the hydrotheca. Station 57— × 42.

Fig. 7.—*Cladocarpus bathyzonatus*, sp. nov., part of hydroclade with hydrothecæ, lateral aspect. *s.s.*(1) = supracalycine sarcotheca with double terminal aperture; *i r.* = diminutive intrathecal ridge in form of a short flap covering opening at base of hydrotheca; *m.s.* = median sarcotheca; *r* = one of the chitinous ridges in the internode; *n* = node; *s.s.*(2) = supracalycine sarcotheca with triple terminal aperture. Station 57— × 42.

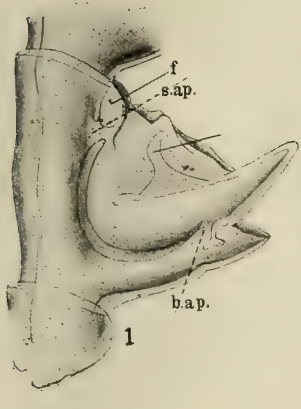
Figs. 8, 9, 10, 11.—*Cladocarpus bathyzonatus*, sp. nov., series showing the development of the median sarcotheca of the hydrotheca. Station 57— × 185.

8.—Lateral aspect; simple terminal and basal apertures.

9.—Half-front aspect, terminal aperture elongated.

10.—Half-front aspect; the walls have joined between the extremities of the elongate aperture, and thus two apertures have been formed.

11.—Half-front aspect—each of the two terminal apertures is raised on a short process.



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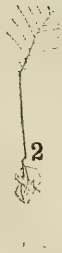

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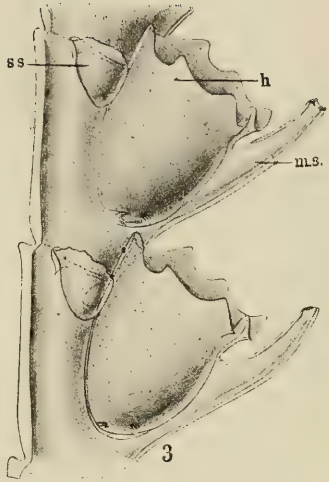

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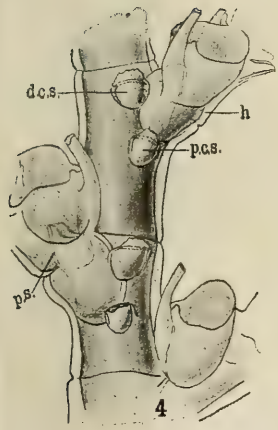

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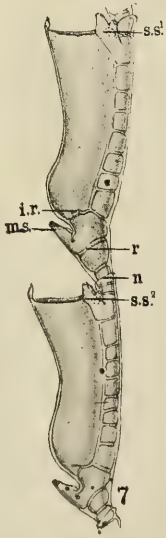

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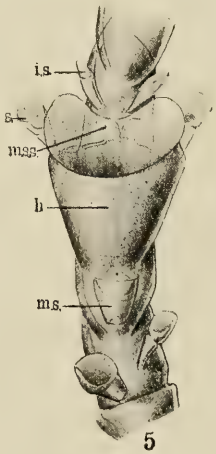

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